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CANCER*

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STATISTICS OF CANCER

HUMAN cancer is on the increase. Just what the absolute increase amounts to is difficult to determine. The figures advanced by the various authorities differ in so far as they have been compiled from different sources and angles of approach. The highest percentages of increase have been derived from the census mortalities; the lowest have usually been obtained from the clinical, biopsy, and post-mortem data.

J. W. Schereschewsky[1] in a study of a continuous twenty-year period, estimates this increase at 46 per cent, basing his figures on one of the most reliable sources of human mortality rates in the civilized world, namely the ten original registration areas of the United States. He covers the period from 1900 to 1920, in an area in which medicine has constantly been abreast of the times. During this period the population of this area rose from about 20 million to 27 million, representing one-fourth of the total population of the United States. This author's painstaking analysis of this subject deserves the most careful consideration.

Using the statistics of the decennial census reports, and the many other facilities furnished by the Census Bureau, Schereschewsky computes the cancer rates by age groups and by organ and system incidence, using, so far as possible, the international classification. His results follow:

The decrease in the population of individuals above forty averaged one per cent less per decade of life at the end of this period. This is the commonest span of life for the development of this scourge, and the fewer individuals reaching it toward the end of the period covered, as shown by this decrease in the upper age groups, would tend to produce a false decrease in the total percentage increase of cancer.

What does this mean? In all probability it indicates that the mechanisms of infant welfare, and of preventive medicine, have been so effective against tuberculosis, typhoid fever and other diseases of young adult life, that more individuals susceptible to disease of later life because of somatic defects attain the cancer age, only to succumb all the more easily to cancer, to vascular, renal and the other diseases of later life, and so fail to attain to higher age groups.

Although this smaller percentage of survivors to the cancer age exerts a false decrease in the cancer rate, the real effect of the latter is to produce a paradoxical increase in the incidence of cancer. Individuals formerly doomed to die before forty from certain inherent defects of development, circulation and nutrition, are now numbered in the ordinary increase of the population. From the standpoint of health, and particularly with reference to cancer and the preventable diseases of

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middle life, they present a momentous problem. If we presume that 10 per cent of the population increase for 1920 was due, not to the added number of births, but to the decrease in infantile and young adult mortality, evidenced by the drop in the rate of these preventable diseases, then 10 per cent of the 7 million increase, or considerably over 700,000 of the 27 million living in 1920 in the area studied, came of that defective type of germ plasm which in the view of many authorities is prone to develop cancer. What influence this 10 per cent increase of tissue defectives has on the total increase of 46 per cent in the cancer incidence can only be surmised.

Schereschewsky makes a very logical analysis of these statistics to ascertain the percentage of increase due to greater accuracy of diagnosis in reports of causes of death, as given in the mortality rate. His conclusion that this new coefficient could account for only 10 per cent of the increase is fairly well grounded and would be most difficult to refute. He points out that this increase is maintained for those cancers of accessible sites (buccal cavity, breast, skin etc.) in which there is a negligible factor of error, and that the decrease of deaths due to ill-defined causes and senility only adds about 10 per cent to the cancer rate, and is, for the most part, transferred to the cardiac and renal groups of diseases. This claim seems fairly well justified if we note that the increase of cancer of accessible sites amounts to 103 per cent, while the total increase is less than one-half this figure.

It could further be claimed with justice, that the 148 per cent increase in the inaccessible sites (peritoneum, intestines, rectum) alone would be more than sufficient to account for the 10 per cent due to better diagnosis (advances made in roentgen ray) of cancer in these inaccessible areas, during this particular period.

In the same period the death-rate from non-malignant tumors has fallen 50 per cent, and the bulk of this must have been transferred to the cancer rate; but the total number was so small as to influence the total percentage very slightly. It must be remembered also, that improvement in the diagnosis of cancer must have been greater in the earlier than in the later stages of the disease, and because of this, its consequent greater number of surgical and other types of cures in this condition, the mortality statistics, as studied by certain groups, would fail to show those so cured. This would tend to make figures which do not include cured cases show, according to the percentages of cures reported from various clinics, approximately a 15 to 20 per cent higher incidence than reported in the mortality rates. From clinical sources, the increase of cure in accessible cancers runs as high as 40 per cent in some sites, yet the increase of the death rate from buccal cancer is 103 per cent, indicating that this figure is much below actuality. When we compare this figure with the rate in the inaccessible portions of the intestinal tract (the greatest increase of all—amounting to 148 per cent), we can infer that the bulk of this increase is due to better diagnosis and to higher rates of post-mortem verification. The failure of cure in these areas, as compared with that in accessible sites, might also be claimed to be even greater than the difference in the mortality percentage increases of 103 and 148.

After indicating that all of his figures were taken from mortality statistics, Schereschewsky concludes that cancer has an apparent increase of 46 per cent during 1900 to 1920, of which approximately 30 per cent represents an actual increase.

Hoffman,[2] using as data the death-rate in twenty-three American cities with a population of over 20 millions (1925) reports an increase of 50 per cent in deaths from cancer. He claims that this increase is real and not apparent, and that the incidence is far in excess of the death-rate. The origin of these figures is probably more accurate than those of Schereschewsky, since Hoffman indicates that they

were collected from reports of large cities where roentgen ray, pathological histology and other diagnostic facilities would be more easily available than in state areas as a whole. This author views the situation as alarming, and states that preventive measures run far behind the increase. He notes that sarcoma makes up 4.8 per cent of malignant tumors. He also quotes figures from the Metropolitan Life Insurance Company, which, during 1911 to 1922 (the latter half of the period studied by Schereschewsky) show a decline in the mortality of buccal cancer of 7 per cent. This decline, in the face of an increase of 103 per cent in the figures of Schereschewsky indicates that the measures against accessible cancer were catching up in the mortality to the present reported clinical figures. The comparison with the other accessible sites of cancer shows a corresponding decrease in mortality rates, with the exception of breast cancer, which has for this period maintained its death-rate practically on a level with the cancer of inaccessible areas. This would seem to indicate that, of the accessible cancers, that of the breast alone is failing to decrease its toll, in spite of the measures of surgery, roentgen ray, radium, and the so-called "radium knife." Those who are familiar with the histopathology of the glands of the axilla, in cancer of the breast, and the story of their very early involvement microscopically, long before there are any palpable or macroscopic evidences of this condition, readily realize why this is so. From the increased use of frozen section in the operating room in the last five years, and the increased measures being brought to bear against the recurrence in the lymphatics of breast tumors, it is reasonable to expect a decline in the mortality of tumors of this organ, and that in the statistics of the coming five years this decline will begin to approach the drop that has occurred in the cancers of other accessible sites. This would represent the usual ten-year lag between the mortality rate, and the curve of the clinical cures, which has already appeared in the other approachable sites of cancer.

The thirteenth annual report of the Harvard Cancer Commission[3] shows a percentage of 13.3 of benign tumors, among the patients who have applied to this clinic, which compares with the rate of 12 per cent observed in the United States Public Health reports for 1900. The latter rate dropped to 7.9 per cent in 1920, and Schereschewsky claims that it was due to the correction of wrong non-malignant diagnoses, which obviously belonged in the malignant column of the mortality rate. The above high rate is easily explained when we consider that the figures are taken from clinical records in an area, and at a time, when a vigorous campaign against cancer is being waged, and where the clinic is called a "Tumor Clinic" in an attempt to avoid the lay stigma attached to the term "cancer," in order to get the operable new growths to the surgeon early enough for the highest possible percentage of cures. This use of the term "Tumor Clinic" has a double value, in that it avoids the horror of the idea of cancer that exists in the lay mind, and so brings patients to the aids for this condition sooner, and also takes advantage of the mechanics of the theory that is so rapidly gaining ground, that there is a possibility of transition to malignancy in benign tumors. These figures are notably reliable, since this clinic follows very closely the histology of all its tumors.

In an article in which he takes the stand that practically all the increase in the incidence of cancer is only an apparent one, M. Ménétrier,[4] taking his figures from autopsies, shows that Bayle[5] in 1816 found 100 deaths from cancer of the stomach in 2556 autopsy reports in individuals aged fifteen years and upwards. He cites these figures, and the proportion in which they appear in the different parts of the stomach, as identical with the incidence of cancer of today, where the figures are taken from the same reliable sources. Ménétrier makes no allowance for the

errors in diagnosis of these early times, which probably augmented the figures by diagnosing some of the chronic inflammations as new growths nor does he charge off from his hospital records of entries the surgical and other cures that must be admitted today.

Taking the records of 7006 autopsies, from the Pathological Institute at Lwów in Poland performed in the period from 1896 to 1903 W. Janusz[6] found 366 cancers, or 5.27 per cent. From 1904 to 1920 in 13,976 autopsies, he found 831 cancers, or 5.95 per cent. In 1922 the percentage rose to 6.6, and to 8.3 in 1924. Both of these two latter authors show a relatively small increase in this condition, as do most of the investigators who take their data from autopsy records.

Analyzing the statistics at a Marseilles hospital L. Imbert[7] reports 11 cases of cancer in 1000 entries in the period from 1871–75, which rose to 40 cases per 1000 in 1920 to 1924. He finds that this condition in accessible sites is decreasing, while it is increasing in the inaccessible areas. He feels that the bulk of this increase is due to better diagnosis, and an appreciable increase in the mean duration of life. The difference in these different areas of the body may be influenced by two factors, the increase of the cures in the accessible, and the improvement of diagnosis of cancer in the inaccessible sites.

SUMMARY OF STATISTICS

It is usual for those authorities who collect their data from autopsies, to set their figures of the increase of this condition much below those who take it from mortality statistics. The clinical groups place the increase about twice as high as the highest presented by the groups obtaining their figures from large series of autopsies, which is a logical result when we consider the proven results of cures, with the modern measures we have at hand, to combat this condition. In spite of this, and the similar excess their figures should show for the same reason over the mortality from cancer, the clinical groups almost without exception grade their estimate of the increase far below that of the pure statisticians, usually computing it at about one-half of the latter's figures.

Until these several groups pool their interest in cancer statistics and a combined paper is prepared, with data taken from all three sources, and compiled in unison, the true figures for the actual increase of human cancer will not appear. This paper would best be prepared at some large clinic where a high percentage of autopsies has been obtained, over a period of several decades, by three co-authors, a statistician, a clinician and a pathologist. The statistician and the pathologist should be writers with mature judgment, and the clinician, a surgeon at the head of a large cancer clinic. The latter should be in close contact with radium and roentgen-ray specialties.

A paper of this sort would correlate our existing knowledge to date, point out in what organs our measures against this condition are failing and probably reveal facts of the highest value to all concerned. Until this paper is written, only the logics of comparison can help us to evaluate the discrepancies of these figures. A conservative estimate from a process of this type suggests that the mortality statistics which when averaged, show an increase of 50 per cent in the deaths from cancer in the last three decades, should be interpreted as follows: Thirty per cent is due to better diagnosis and greater accuracy in reporting causes of deaths. Ten per cent represents an actual increase in the incidence, due to the greater number of individuals, with no greater susceptibility to this condition than the persons who reached the cancer age twenty years ago, and who now attain it to swell the numbers that succumb to this dread incubus. The remaining 10 per cent, another real increase of incidence, is probably due to a larger number of individuals reaching the later decades of life, with those somatic defects of tissues and organs which are

thought to raise their chances of having cancer.

While this apparent and real increase has been going on, there has been a remarkable advance in the surgical, roentgen-ray, and radium measures for the cure of this condition, and because of the same improvement of diagnosis which has so augmented the death-rates, these measures have been applied to cancers in much earlier stages than ever before. The result is that conservative clinicians claim that 30 per cent of cancer is being cured. What does this mean? This 30 per cent of cures is obviously missed in a study based on mortality rates. On the other hand, this percentage is computed for the most part on the so-called operable cases, and for this reason represents only about 50 per cent of the totally observed clinical incidence of this dreaded scourge.

CONCLUSIONS

Therefore one-half of this 30 per cent of cures or 15 per cent, must be added to the mortality rates, making an actual net increase of 35 per cent, which probably represents the actual increase of the menace of cancer to the human race, not explainable in any way except possibly in the changing human habits brought about by modern civilization, since this increase is not observed in virgin races. This is further borne out in the fact that amongst these virgin races sarcoma makes up one-half of the incidence of new growth while in civilized peoples it has fallen behind cancer to the extent that it only occurs once in ten malignancies.

THEORIES OF CANCER

James Ewing[8] defines tumor as "an autonomous new growth of tissue," and goes on to a description of the etiological influence the various causative factors have upon the production of tumors. The factor of heredity he justly confines to the gliomas, which, though they definitely follow some of the hereditary laws, are the most atypical of tumors, answering but few of the general laws of new growths. He then goes into the theory of trauma as a cause of tumors, with a single large trauma as the cause of sarcoma, and the long-continued low-grade traumata as the causes of pipe cancers and the cancers of paraffin and roentgen-ray workers, chimney sweepers, betel nut chewers, of the carriers of Kangri baskets, and of those who handle tar. He also mentions the appearance of cancer in the thyroid of fishes as the result of exaggerated response to physiological stimuli, and the origin of tumors in the regions undergoing repair following tuberculosis, syphilis and the other chronic infectious diseases. Ewing passes over very lightly the possibility of cancer regions, houses and families, and does not seem to put any credence in the other geographical or meteorological reasons assigned by countless authors as causes of this condition. In a like manner he indicates that the various parasites that have been accused of causing cancer, act as do the chronic infectious diseases by producing that condition of over-repair which acts as the finer traumata and irritations that are followed by tumor.

Although the parasitic theory has had many adherents, and numerous gross and microscopic organisms have been seemingly convicted of producing cancer, the very multiplicity of this list is excellent evidence that they will all join that great parade of specters of the past that have been so accused. The latest and most attractive of these theories as reported by Gye and Barnard[9] described cancer as caused by a filterable virus which consists of two separable elements: one, a non-specific virus which is thrown down by the centrifuge, is thermo-labile, and is destroyed by chloroform and other chemicals destructive to life; the other a specific thermo-stabile chemical substance, resistant to these chemicals, which determines the cellular character of the transplanted tumor. In the first paper the authors suggest that irritation may by some chemical or physiological action furnish the specific factor

which allows the virus to infect, and, in this manner explain why an infecting agent can show in many tissues the peculiar cellular reaction that each tissue shows to new growth. These authors have photographed with ultraviolet light certain spherical bodies which they claim to be the specific virus. In a second paper of greater detail and furnished with charts that show the inhibiting influence of various antiseptics on this two-factor virus, Gye defends his theory against the many criticisms of authors who have endeavored to repeat his work. J. B. Murphy,[10] of the Rockefeller Institute, after attempting to parallel this work, concludes that the power to activate a chloroformed filtrate is not proof of a living organism, since he found that tissue cultures of embryonic cells and of placenta are as powerful in this respect as are the so-called cultures of malignant tumors. This author feels that the causative agent of the chicken sarcoma of Rous may be an enzyme-like substance which can be inactivated by chloroform and similar chemicals, and in turn reactivated by a diffusible extract of new growths, embryonic or placental tissue, or that the chemical treatment so attenuates this substance that it is only revived by the extracts from the "cultures." Anaerobic cultures of chick embryo and rat placenta are just as effective as the so-called cultures of Gye in activating the chloroform-treated filtrates of chicken sarcoma.

In a résumé of the cytology of cancer R. J. Ludford[11] discusses the etiology of this condition from the present state of the knowledge at hand of this subject, and compares the culture of tissues to the cellular activity of tumors. In both, the growth is continuous as long as the medium is satisfactory and the supply of nutrition is maintained at the proper level, and in the cultures if the sub-culturing is adequately carried on. He disclaims any specific cytological attributes peculiar to cancer, other than those that are found in any rapidly growing tissue, except those produced by the inability of the stroma to handle the problem of nutrition.

Ludford weighs many of the theories of new growth and discards those that are found wanting, either for lack of proof, or their failure to apply to all types of this condition. The embryonic rest theory of Cohnheim infers that certain cells fail to continue to divide at the same rate as their neighbors during the rapid cell division which occurs in early fetal life. These cells in adult life for some unknown reason suddenly take on the rapid cell division characteristic of the fetal span of existence, and result in cancer. This theory answers very well for teratomas and embryomas, but as will be shown later, unless combined with other theories, it does not apply well to the commoner and much more numerous new growths. The many cytological theories are discussed by Ludford and excellent reasons are given for discarding them. The gametic theory infers that the heterotypic mitotic form of cell division that occurs in germ cells is taken on by tumor cells which by this means throw off the somatic control of the body, multiply at its expense without contributing any function to its common welfare and live on it purely as parasites. This same autonomous urge in the gametes of the lower animals enables them to live in the fluids of the parent and in the higher animals allows them to develop the placenta which has the ability to invade tissues and to assume practically malignant tendencies in its search for nourishment from the tissues of the parent. This theory is discarded by Ludford for the lack of proof that this type of mitosis exists in new growths.

The chromosome theory of Boveri holds that malignancy results from an initial abnormal cell division, one of the daughter cells of which has a chromatin content which enables it to exist independently of the somatic factors that control cellular growth. These attributes allow the resulting group of cells to assume the autonomous character described by Ewing, and

the parasitic rôle of existence exhibited by all tumors. Ludford's article contains an excellent histological, physiological and mechanical description of a cell, which includes all of the accepted knowledge of this subject to date and affords an elaborate working plan of this structure, of inestimable service in the consideration of any theory of cancer. The extent of malignancy is measured by the amount of variation from normal function shown in the internal structure of cells as well as in their arrangement to simulate the normal form of organ or tissue complex as expressed in the region from which they arise. The greatest variation of cellular structure is found in the Golgi apparatus; yet this change does not entail any wide variation from that of the cells of the normal tissues from which the tumor arises, so that such a change cannot be labeled as characteristic of cancer. The variation is a quantitative rather than a qualitative one. The variations of the polarity of cells is the factor that makes tumor tissue seem to differ so markedly from normal, and is only consequent on the degeneration of the function of the cells which the particular new growth happens to show. The amount of stroma governs directly the polarity of functioning cells, determines the distribution of their mitochondria and the amount of variation they show from the normal. The hypertrophy of the stroma which accompanies new growth and makes the nuclei of this tissue larger and more conspicuous and the cytoplasm and its products grosser and more easily discernible is undoubtedly caused by the same growth-promoting urge that is responsible for the malignancy of the so-called parenchyma of the tumor. This is probably augmented by the autolysins from the necrotic portions of the tumor. The abnormal appearance of the chromatin of tumor cells, the process of the formation of inclusion bodies and the production of nuclear fragmentation are all ascribed by the author to functional or pathological expressions of rapid cell division.

Ludford also refers to the theory of Brailsford Robertson, which proposes that asymmetrical mitoses are factors in cancer, because of the possibility that the daughter cell with its larger nucleus and smaller amount of cytoplasm has a consequent greater portion of its energy and nutrition directed toward reproduction and away from function, thus enabling its progeny to overcome the tissue tension and growth restraint of its neighbors and to become cancerous. Giant cells are thought to be the result of various defects of mitosis due to faults of nutrition and of those growth-inhibiting substances in rapidly growing tissues that necessitate sub-culturing in the in vitro experiments of normal and cancer tissue cultures.

In an excellent article on the experimental production of new growths with oils, Burrows and Johnston[12] claim that the factors of function and of growth are balanced in normal adult tissues, and that new growth is due to a loss of this balance. The rapid growth of an embryo is maintained by the high quality of the nourishment furnished through the placenta, and continues until the new individual is brought to the stage where it begins to function, and has to elaborate its nutrition from foods of a more highly organized character. As this transition takes place the tissue energy is turned from growth and reproduction to function, and only so much of the former remains as is necessary to the automatic replacement and repair needed to combat disease and take care of the wear and tear incidental to normal function. Then any abnormal call for repair or replacement that is continued and repeated, as is the case in chronic inflammation, or any fundamental change in the character of the nutrition of a part or organ, may divert the energies of a tissue from function to growth, and if the factors that govern this change have any of the elements that make for a vicious circle, embryonic speed of growth occurs, and cancer may result. Burrows and

Johnston claim that tissue cultures elaborate a substance which stimulates cell division, that small quantities of this substance cause the cells to digest fats and proteins, that larger ones promote reproduction and that still larger quantities produce autolysis.

SUMMARY OF ETIOLOGY

A summary of these facts about cancer and the theories that seem to be justified by them might be enumerated as follows:

Ewing's definition of cancer, "an autonomous newgrowth of tissue," might be interpreted to mean that a tumor represents a local rebellion in a tissue or an organ, a declaration of independence on the part of a group of cells, with an attempt to throw off the yoke of service to the body as a whole.

This results in a mass of cells, in or on a tissue or organ, which attempts to refuse to function, and to divert all the local nourishment to the establishment of a separate entity. This idea of a separate entity is well expressed in the teratomas, and reaches its extreme form in the true parasitic monsters. At the other end of this scale of pathological events is the normal degree of the usual process of repair in tissue. The events in between are so varied, that the logics applied to the cause of cancer have resulted in an almost infinite list of the theories of its etiology. The cause and effect mechanics of the process of repair are most intricate. The first to be considered is infection, which when it is acute, results most often in a normal repair process that fills the resulting defect to the limit of its ability. In many instances this may be complete, and an excellent example is seen in lobar pneumonia, where even though the portion of the lung affected may seem to be a frank collection of pus, apparently obliterating the alveolar walls, the area becomes organized, and no scarring or other remnants of repair remain behind; the texture of the lung appearing as before. From this apparent complete repair at one end of the scale, there is every degree of incomplete repair, even in the wake of the acute infectious diseases, that afford the opportunity of over-repair that is included in the term chronic inflammation.

This condition includes the arches of young blood vessels that are always present in an organizing area, which may completely disappear, at the lower end of the scale, and those overgrowths of young connective tissue, which are difficult to differentiate even under the microscope from the slower growing sarcomas, on the other end. These arches of young blood vessels are a most important factor in the physiological consideration of the etiology of new growth. They furnish two of the factors dwelt upon by Burrows and Johnston[12] in their consideration of the cause of cancer, so well supported by their work on tissue and cancer transplants, and so richly elaborated by the work of countless other research workers. One is the additional nutrition apparently fitted for the growth as opposed to the function of tissues, and the other is the presence of young connective tissue ideal for cancer stroma, and the embryonic attempts on the part of gland or other parenchymal structures, to replace such functioning areas as have been lost. Add to this the usual tardiness of nerves in the process of repair, with the loss of their trophic and sympathetic inhibitions, so necessary in the balancing of function against repair and replacement, and we have the ideal situation for a form of tissue insanity, in which normal function with its moderate demands for nutrition is unseated, and an embryonic speed of growth results. This rapid growth is ordinarily confined to a very small per cent of the tissue activity, and only operates sufficiently to take care of repair and replacement, made necessary by the ordinary wear and tear in a tissue or organ. When automatic repair and replacement usurp the place of function in a tissue and run riot, with a speed of growth only seen in the embryonic span of life, these cells secede from the economy of the tissue or organ and become cancer.

The physical or cellular elements that underly the etiology of cancer are well illustrated in the various phenomena that occur in chronic inflammation. In addition the rôle that fat, and fat soluble substances, play in the production of experi-

mental cancer, also indicates that the fatty degeneration occurring in many processes of repair may also have a chemical influence comparable to the use of paraffin and other oils in the production of cancer.

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A CONTRIBUTION TO THE DISCUSSION OF PAGET'S DISEASE OF THE NIPPLE AND GYE'S HYPOTHESIS

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THE text of this discussion is taken from Figure 1, a photograph of a whole breast slide from tissue sent by Dr. W. L. Lathrop and Dr. R. A. Gaughan of Hazelton, Pa. The case history follows:

Mrs. F. H., 60, married, three children, youngest 26, no miscarriages, had a "lump" in the breast for twenty years, and ulcerated nipple for six months. Rapid growth during this latter time. Admitted to State Hospital, Hazelton, November, 1926. The nipple has disappeared and is represented by an ulcerated area typical of Paget's Disease. The entire breast is hard but no distinct nodules can be felt. There are nodules in the axilla. November 18, 1926, radical operation. Died at home January, 1927 of acute pneumonia beginning with a chill. Glands in axilla show invasion under microscope.

It is important to note that according to the hospital history the patient considered that she had a lump in the breast for twenty years, the nipple had been ulcerated six months, the entire breast was hard but no separate mass was felt, and there were no chest signs while the patient was in the hospital. The fatal pneumonia about two months later seems to have been acute.

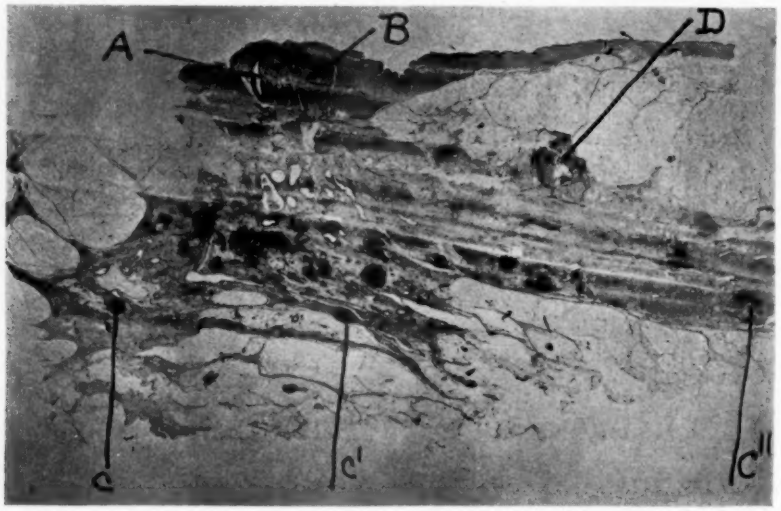

FIG. 1. Photograph of entire breast section. Reproduction is actual size of microscope slide. The tissue is somewhat shrunken from the size in the fresh state by the formalin fixation. At A is a duct which can be traced for about 7 mm. This duct is shown in Figure 3. At B is the comedo type of growth shown in Fig. 4; C, C,' and C'' indicate three of the separate scirrhous nodules. Similar small dark spots are all separate scirrhous nodules. Over twenty can be counted in this slide. Point C is 8 cm. from C'' in the actual slide. One of these scirrhous nodules is shown in Figure 5. At D is the nodule showing a marked glandular type. This is shown in Figure 6.

Examination of the entire photograph (Fig. 1) shows:

(1) A thickening of the epithelium of the nipple about 1½ cm. in diameter. Under the microscope this is a typical squamous epithelioma showing all the characteristics frequently described (Fig. 2).

(2) In the dense subcutaneous tissue of the nipple several dilated ducts can be

seen in all of which there is an overgrowth of epithelium quite similar to the typical squamous-celled epithelioma on the surface. This extension of the malignant epithelium down the ducts has also often been described. Figure 3 is a low power photomicrograph of a duct at A in Figure 1. The opening of this duct on the surface is seen and the duct can be followed down in the section for about 7 mm.

(3) In the dense connective tissue of the nipple are several places where the malignant process is of the comedo type (Fig. 4).

(4) Beginning about 1½ cm. under the nipple surface there are several dilated ducts the epithelium of which shows only a slight degree of ordinary proliferation.

(5) Scattered throughout the entire breast tissue there are scores of separate and apparently independent nodules of typical breast carcinoma of the scirrhous type.* The smallest ones are visible only under low power. The larger ones (4 to 5 mm. in diameter) are easily seen in Figure 1 in their actual size. Many sections have been made at different levels of the breast and these minute scirrhous growths are quite the same in all. The most distant ones are about 8 cm. apart in the formalin-shrunken tissue (Fig. 5).

(6) About 2½ cm. to the right of the nipple at the junction of breast tissue and subcutaneous fat there is a larger nodule (about 5 mm. × 8 mm.) which even the naked eye can see is different from the scirrhous nodules. Under the microscope this is a glandular type of growth, definitely carcinoma and resembling the so-called sweat gland type of Ewing (Fig. 5).

To sum up, there are in the same breast four different types of carcinoma: (1) squamous epithelioma, (2) comedo type, (3) scores of separate scirrhous growths, and (4) a sweat gland type.

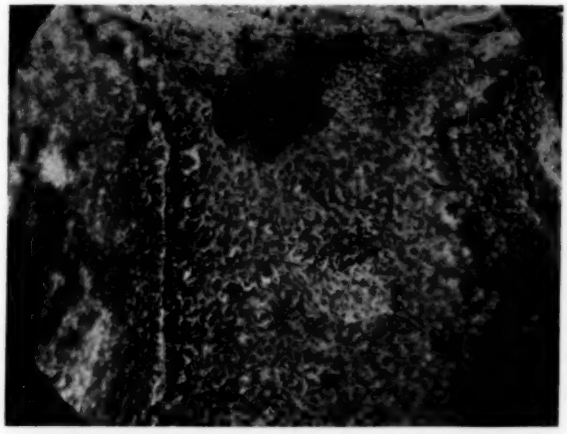

Fig. 2. Surface of the nipple showing squamous-celled epithelioma. The line AAA is the actual surface.

Fig. 3. Low magnification of the duct at A, Figure 1. Showing the very much thickened epithelial lining traced into the deeper part for 7 mm. This thickened epithelium is undoubtedly malignant and part of the squamous epithelial growth seen at the surface. The point E in this figure is shown in higher power in Figure 2.

Three master surgeon-pathologists, Sir Lenthal Cheatle and Mr. Handley in London, and Dr. Bloodgood in Baltimore have recently made valuable contributions to the literature. All of these writers have convincingly demonstrated their own points of view. Confusion still exists, however, because, including other writers "Paget's disease" has been used as a blanket term to cover any condition in the nipple, from those which can be cured by a little soap and water to those which are not cured by extensive operations.

It would seem that Handley[1] has shown

*The word scirrhous, which is being discarded by some pathologists, is retained in this article not as indicating a separate variety of carcinoma but as a descriptive word best expressing the well known architectural arrangement between epithelium and connective tissue.

conclusively what should be considered as the condition described by Paget and consequently the only one which should go by Paget's name. According to Handley the change in the nipple in Paget's disease proper is in no way a neoplastic but rather an atrophic process caused by interference with lymphatic circulation due to the infiltration of carcinoma cells under the papillae of the nipple and areola from an underlying breast cancer which may have been dormant for a long time and produce its first outward manifestation in the nipple in this way. This is why Paget discovered clinical carcinoma in the breasts later. Handley's illustrations definitely establish this condition as a clinical entity and the logical one to call Paget's disease. Very obviously, as Handley emphasizes, this condition has nothing to do with squamous-celled epithelioma of the nipple. If this distinction will hold, the present confusion will cease.

Fig. 4. Comedo type of growth seen at point B in Figure 1.

Sir Lenthal Cheatle[2] has two very scholarly papers under the title of Paget's disease. It would seem to me, however, that the conditions he illustrates are frankly squamous epithelioma and if accepted on this basis Cheatle's work goes far to solidify our knowledge of the latter condition and also helps to distinguish what Handley terms true Paget's disease. Cheatle has definitely proven an important fact in connection with squamous epithelioma, that is, that it is frequently associated with carcinoma of other types deeper in the breast. This association of deep carcinoma with both squamous epithelioma and true Paget's disease is another factor that has confused the two diseases. Cheatle also shows that in squamous epithelioma the carcinomatous process extends deeply from the surface and involves the duct epithelium for considerable distances (see Fig. 2). Cheatle, at least in 1924, seems inclined to believe that it is this downward spread through the ducts that produces deeper true breast carcinoma later. This point will be considered below.

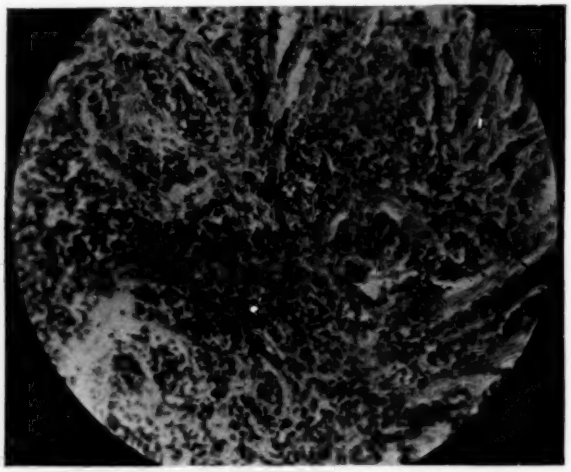

Fig. 5. A scirrhous type of nodule scattered by the score throughout the entire breast. Shown in Figure 1 at c, c′ and c″ etc.

Bloodgood[3] has rendered great service by calling attention to the fact that the nipple, like any other portion of the body, may be the seat of eczema, dirt irritation, and other conditions that yield readily to soap and vaseline or silver foil protection and should not be dignified with the name Paget's disease or squamous epithelioma or any name suggesting the need of surgery. It is, of course, very important that these benign, easily curable lesions should be included in any discussion of nipple diseases but it should be emphasized that they are to be definitely distinguished from Paget's disease and also from squa-

mous epithelioma. (Basal celled epithelioma of the nipple occurs very rarely.)

Bloodgood has also noticed the spread of the carcinomatous process down the ducts and the presence of carcinoma deep in the breast tissue. He does not discuss the connection between the two except to say that he considers the nipple carcinoma to be the primary one. Kilgore,[4] after a study of Bloodgood's sections, is also of this opinion. Bloodgood states that in squamous epithelioma of the nipple he has seen axillary involvement without involvement of the breast tissue. With the ordinary small slides evidence on this point must be considered as negative evidence. When more sections of the whole breast are studied this situation, like many others, may change.

As noted above Cheatle, Bloodgood, and others have seen both squamous-celled epithelioma of the nipple and deep breast carcinoma at the time of observation and there has been a long discussion as to which is primary and which secondary. It recalls the argument concerning the hen and the egg and the disputants are still as far apart as ever in both cases. I do not recall that anyone has ventured the opinion that neither is secondary to the other but that both arise independently at or about the same time from a cause or causes that have equally affected both places.

The very unusual specimen shown here seems to throw considerable light on the relation between the superficial and deep carcinomata and also on the question of multicentric carcinoma in general.

To recapitulate, there are in this section: First, scores of apparently independent foci of scirrhous carcinoma all apparently of the same age and stage of development and each one apparently independent of the others. Second, one glandular type nodule. Third, definite comedo types. Fourth, squamous epithelioma. The more this slide is studied the more it seems that the nodules could not have been spread by lymphatics from an original focus. Certainly, such an original focus would be larger, more advanced and plainly evident. Also if it were spread by lymphatics the type of growth would be essentially the same all over. Four different types would not be caused in this way. Again, if we eliminate the glandular nodule and the comedos in this slide as accidental and at all events unexplainable, there is still a squamous-celled epithelioma of the surface and a scirrhous growth in the breast. This is the condition, as already noted,

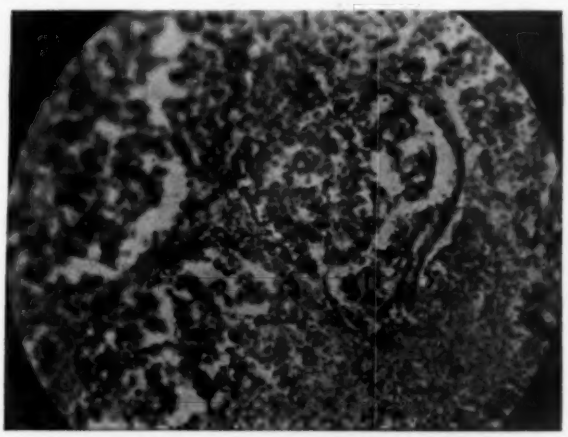

Fig. 6. The glandular type of growth shown at D, Figure 1.

which has been described by Cheatle, Bloodgood, and others. This is the condition that has caused so much discussion as to which neoplasm is primary and which causes the other. So far as I know the discussion has been only as to which is primary. All writers agree that it is simply a matter of spreading from one to the other, that the squamous epithelioma spreads down to the breast and there starts a scirrhous; or, vice versa, the scirrhous spreads to the nipple and there the picture becomes that of squamous epithelioma. From what we know of the specificity of any growth it is very hard to understand how this change can take place. In other places when a scirrhous growth spreads it retains its essentially scirrhous character. If it reaches the liver it is still scirrhous, changed a little perhaps by mechanical environment but scirrhous nevertheless. If a

squamous epithelioma spreads to bone it retains its own character, it never starts a bone cancer. So it may seem that for a squamous epithelioma to spread into the breast and there appear as a scirrhous, or vice versa, is quite at variance with all that we know about the spread of neoplasms. Therefore, direct spread of carcinoma by lymphatics seems entirely inadequate to explain the condition in Figure 1.

It would seem that the only hypothesis that can explain the findings in Figure 1 is Gye's. That is, it would seem that there had been some change in this breast which produced Gye's specific substance in many cells all through the organ. Then the infecting agent was introduced in some way and independently scores of scirrhous nodules started all through the breast tissue; in at least one spot a different type of cell was involved and it developed its own type of glandular carcinoma. Another type of cell was driven into malignancy and had to produce the comedo type. The surface cells, also driven into malignancy, produced their own type, the squamous epithelioma. Figure 1 is a fact, not a theory, and it is maintained that it can be explained by Gye's hypothesis only. What Cramer[5] has said of Gye's hypothesis in another connection applies directly here, that "It does not conflict with any previously established facts. It confirms them. . . . It removes all apparent contradictions. It explains all the essential features of the disease."

SUMMARY

1. The nipple, like any other portion of the body, is subject to non-malignant diseases.

2. Paget's disease is a distinct entity due to disturbance of nutrition from permeation of cancer underneath. The deep cancer may not be clinically evident till some time later. It is not a neoplasm of the nipple. Especially, it is not squamous-celled epithelioma.

3. Squamous-celled epithelioma of the nipple is often if not, in time, always, associated with carcinoma of deeper portions of the breast.

4. This association is not adequately explained by spread either direct or by the lymphatics. It is adequately explained by Gye's hypothesis.

5. Figure 1 represents a condition that can be explained by Gye's hypothesis only. The author is indebted to Mr. W. I. O'Neill of Columbia University for the photomicrographs.

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Note. Since the above went to press a very valuable article which should be read in the original has been published by Muir, *J. Path. & Bacteriol.*, 1927, xxx.

PRELIMINARY REPORT OF A MODIFIED METHOD OF BLOOD COUNTING FOR THE DETERMINATION OF INFLAMMATORY CONDITIONS*

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THE hypothetical clinical picture which I am going to draw is one which has occurred in the experience of all practitioners. A patient presents himself for diagnosis with indefinite abdominal complaints, such as nausea, vomiting and pain in the right lower quadrant. The pulse, temperature, and respiration are all within normal limits. There is some tenderness in the right lower quadrant, but there is enough doubt in our minds to make it advisable to confirm our suspicion by resorting to the information which we feel can be gained from a white and differential blood-cell count.

The results of this count are: white cells 10,000, with 70 per cent polymorphonuclears. Knowing that the possible factor of error in a total white count is plus or minus 2000, we realize that this figure may mean 12,000 or 8000. Hence we gain no particularly valuable information from the determination of the total number of white cells. In a like manner, realizing that the factor of error in a count to determine the number of polymorphonuclears is plus or minus 5, we know that the Figure 70 may mean 75 or 65. Both of these features have such wide variations within the normal that these figures prove of no great value.

Under such circumstances, in many instances diagnosis is delayed in the hope that another white count at the end of six to twelve hours will be more clearly indicative. This delay has been the cause of many deaths, as by the time the white cell and differential count have become clearly indicative of inflammatory processes, the information thus gained may come too late.

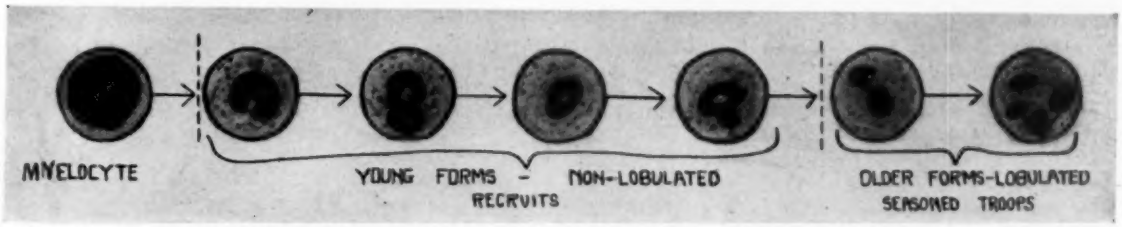

FIG. 1. Scheme of development of the nucleus of maturing polymorphonuclear neutrophile.

The facts that such a large amount of reliance has been placed in a white cell and differential count, and that this method of blood diagnosis has frequently yielded information that was misleading, bring out two important observations: first, that blood counting has lost prestige among diagnosticians, especially in cases of early inflammatory processes; second, there is a distinct need for some method of blood examination that will yield this information at a time when it is a factor of prime importance.

Because I felt that hematology was a weak link in the diagnostic chain from the surgical standpoint, the title of Piney's

* Read before the Jefferson County Medical Society, Birmingham, Alabama, February, 1927. Published under the auspices of Surgical Section B, Fifth Avenue Hospital and the Surgical Foundation.

article,[1] "The importance of Hematology in Surgery," rather piqued my interest. After reading it I felt that the theories in it I am offering to the profession a stout staff in place of the straw, particularly in borderline cases when we feel that some

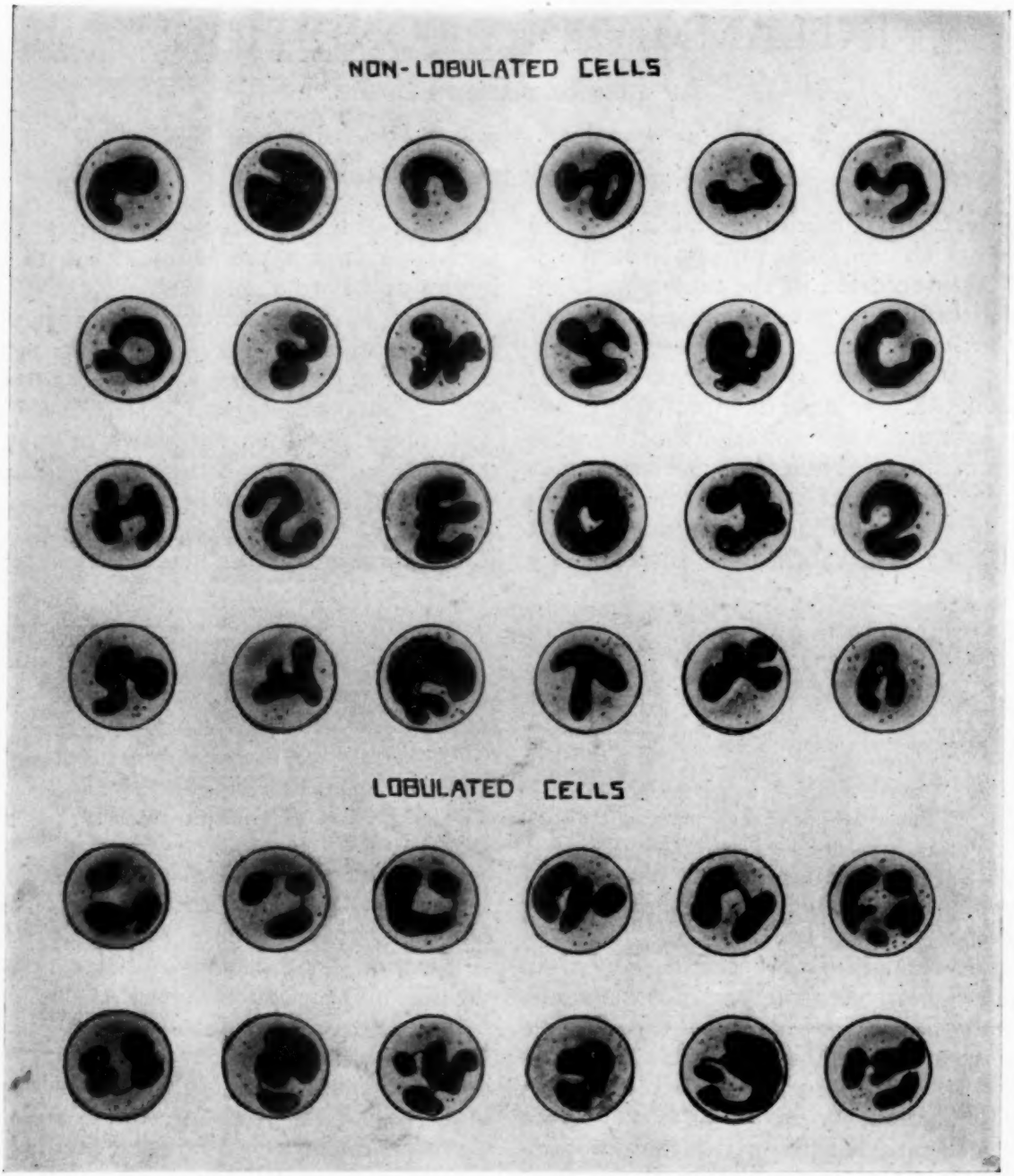

FIG. 2. Diagram showing typical instances of non-lobulated and lobulated forms.

which he advanced were of such importance that the subject warranted earnest consideration. It is as a result of that study that the following modification of Piney's technique is suggested. I hope that laboratory examination will be of assistance where signs and symptoms are indefinite.

We must revise our method of considering the polymorphonuclear neutrophile in inflammatory disease.

Arneth,[2] von Schilling-Torgau,[3] and various other writers, have attempted classifications of these cells with the idea of determining their relative age. Arneth was the first, but in the hands of most men his classification has proven so complex that its clinical value has been lost. Von Schilling-Torgau's classification was somewhat simpler, as was likewise Piney's, but I felt that there is a possibility of improving on these.

It is not my purpose in this article to enter into any discussion of the origin of the white cells for I believe that such a discussion at this point would only lead to confusion. I am basing my deductions upon that portion of the theory relative to the origin of polymorphonuclear neutrophiles which traces their development in the white-blood-cell-forming organs such as the marrow of the long bones, spleen, liver, lymph nodes, and lymphatics of the omentum, from the myelocyte. This portion of the theory of cell origin is accepted by the majority of authorities and I refer the reader for confirmation thereof to any

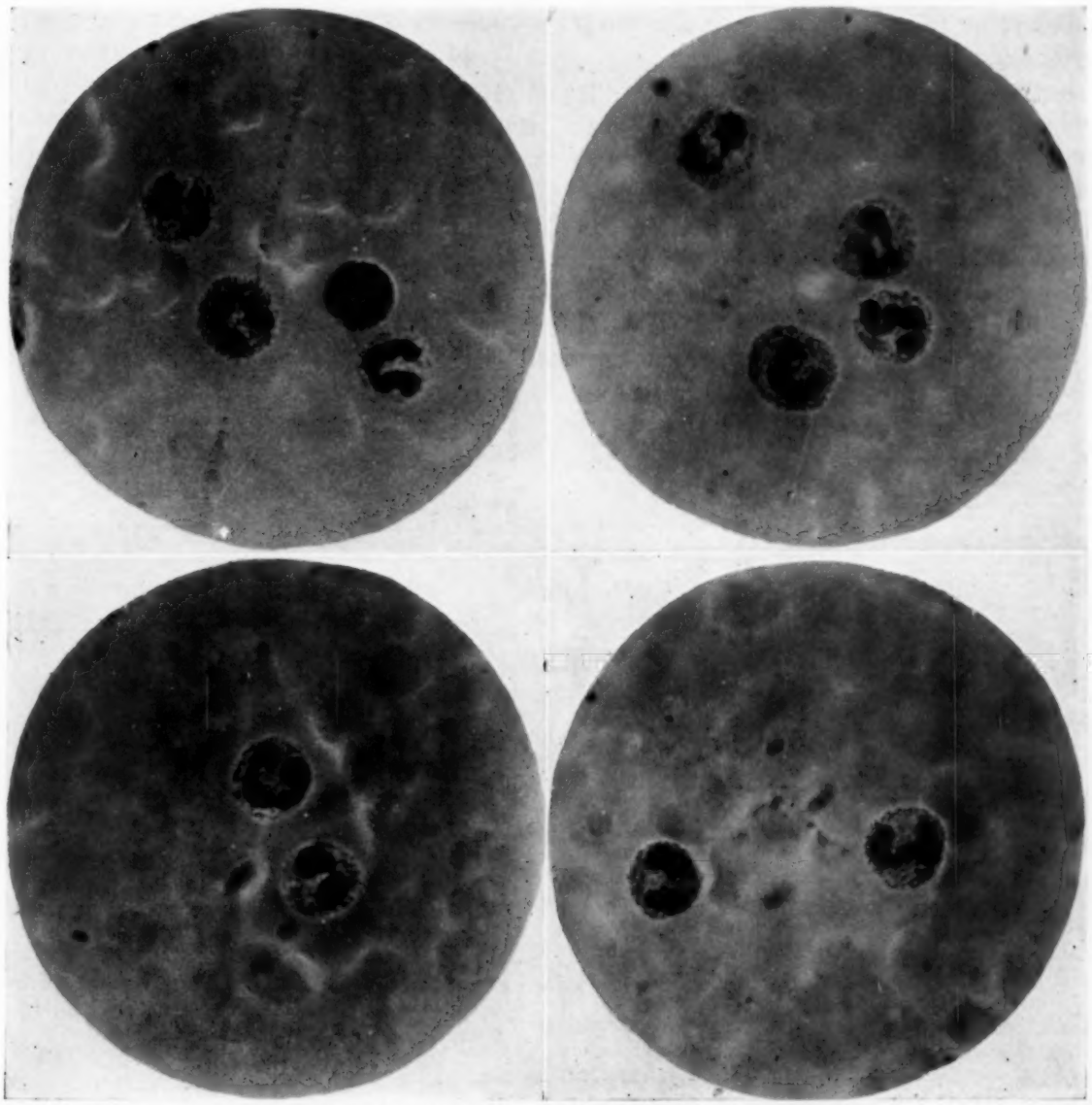

Fig. 3. Photomicrographs (untouched) showing lobular and non-lobular polymorphonuclear neutrophiles in the peripheral circulation of a case of septicemia.

of the standard textbooks of histology, embryology and pathology. More recently, Sabin has added materially to our knowledge of the subject and her monographs on the behavior of white cells are the finest in the field.

The myelocyte is continually developing into, amongst other cells, the polymorphonuclear neutrophile. This change is accomplished by the addition of neutrophilic granules to the cytoplasm and the typical metamorphosis of the nucleus

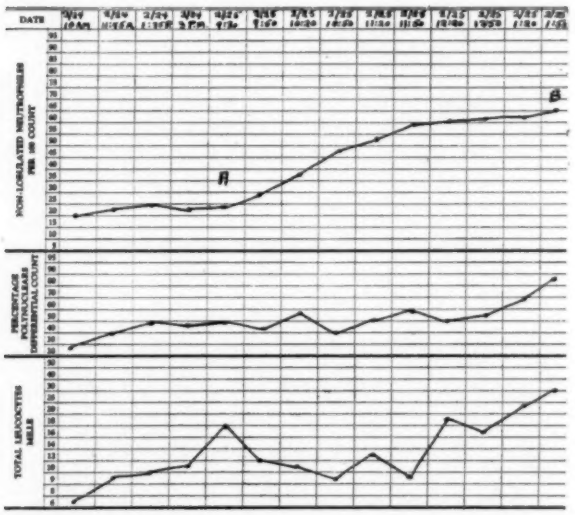

Fig. 4. Rabbit No. 1. Showing comparative behavior of total number of leucocytes, percentage of polymorphonuclear neutrophiles and percentage of non-lobulated forms when the peritoneum was injected with 20 c.c. of fresh culture of mixed bacteria from a carbuncle. Culture injected into peritoneum at point A. Rabbit died at point B, following the development of generalized paralysis and acceleration of pulse, temperature and respiration. It will be noted that rise of non-lobular forms occurs before marked rise in percentage of polymorphonuclear neutrophiles.

which eventually assumes the characteristic shapes that give the polymorphonuclear neutrophile its name.

It is quite obvious that between the stage of the disc-shaped nucleus of the myelocyte and the characteristic shape of the polymorphonuclear's nucleus there are certain mechanical stages through which that nucleus must go. The disc becomes indented and assumes a somewhat kidney-like appearance. This elongates and becomes the horseshoe-shaped nucleus of the metamyelocyte. Further growth produces the "s" "3" and "o" shaped nuclei of the younger cells. This development progresses and there eventually comes a time when some portion of the nuclear mass is almost completely pinched off from the main nucleus (Fig. 1).

Owing to the difficulties and complexities of the previous classifications which created sub-groups for the polymorphonuclears according to the number of

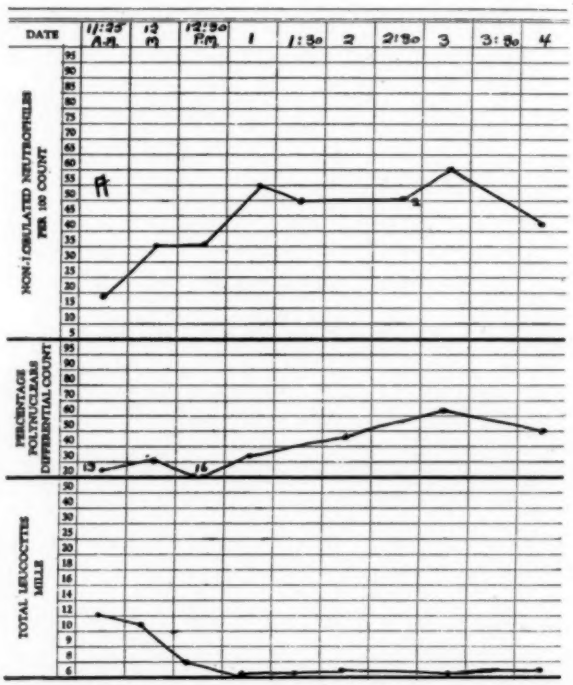

Fig. 5. Rabbit No. 2. Repetition of former experiment using 5 c.c. of fresh culture. Peritoneum injected at point A. This rabbit ultimately recovered.

lobules in the nucleus, or used such terms as "ring" and "band" forms—classifications or sub-groupings that proved confusing to the average worker—it occurred to me that it would be interesting to determine how many of the polymorphonuclear neutrophiles in the peripheral circulation had a portion of the nucleus pinched off. So I selected a purely empirical classification and have divided the polymorphonuclears into two groups, those having a portion of the nucleus pinched off, which I call "lobulated" polymorpho-

nuclears, and those in which no such division has taken place, which I call "non-lobulated" polymorphonuclears. To be more concise, I define a lobulated polymorphonuclear as one in which some portion of the nuclear mass is separated from the main nuclear mass by a strand of chromatin, both sides of which are not distinctly visible under the two millimeter oil immersion lens (Fig. 2).

To draw a rather homely simile, the cells that fall within the non-lobular classification are those in which the nuclear picture could be readily reproduced by squeezing toothpaste from a tube continuously. In order to reproduce the nuclear picture of the lobulated cell, it would be necessary to stop this squeezing process and begin at a second, third or fourth point.

This classification is empirical but it has many advantages, the greatest of which is that it can readily be understood, and it has been my experience that with it as a working basis three individuals counting the same slide will not vary more than two or three cells. Figure 3 shows photomicrographs of polymorphonuclears in the peripheral circulation of a case of septicemia and serve to show that this classification is readily made.

"NORMAL" COUNTS

Age groups	15 years or more
Percentage of non-lobulars	
35	xx
34	x
33	
32	x
31	x
30	xxxx
29	xxx
28	xxxxxxxxx
27	xxxxx
26	xxxxxxxxx
25	xxxxxxxxx
24	xxxxxxxx
23	xxxxxxxxxxxx
22	xxxxxxxx
21	xxxxxxxxx
20	xxxxxxxxxxxxxxxxx
19	xxxxxxxxx
18	xx
17	xxx
16	
15	xxx

Distribution of the non-lobular determination in 118 normal individuals.

The technique employed in this method of blood examination is the same as for the routine differential count. A drop of blood from the lobe of the ear is placed upon a cover glass, a second cover glass is dropped upon the first, they are slipped apart, and the cover glass preparations are air-dried and stained with Wright, Jenner, or the tetrachrome of McNeill. One hundred polymorphonuclear neutrophiles are counted on each cover glass after the usual differential count has been made, the percentage of non-lobular forms is determined and an average of the two figures is taken as the factor for that count. For instance, cover glass A shows 23 out of 100 polymorphonuclears counted to be the non-lobular variety and 27 on cover glass B. This is expressed by saying that there are 25 per cent of non-lobular forms present.

My first problem was to ascertain whether there were any consistency in the percentage of non-lobular forms present in the peripheral circulation of normal humans. For this purpose one hundred and eighteen individuals, who were under observation, were examined, and three counts were made in each instance. The average distribution of these counts reveals that there are in the vicinity of 25 per cent of the non-lobular form under the climatic and atmospheric conditions of Greater New York during December.

I have taken the figure 25 as our average normal, and I believe that the presence of this many or less of the non-lobular forms in one hundred counted, shows that there is no acute inflammatory process present in the individual. The only wide variation from this figure that is non-pathological is in the case of menstruating females in whom the number rises to about 35 per cent.

I have counted the cells in children as young as six days and find the percentage to be about the same. I do not feel that my figures for children at the present time are large enough to warrant any normal. However, it has been my experience, so far, that even in infants of two or three days of age the same proportion

holds good as for adults. Since white cell and differential counts in children are even more essential than they are in adults this is the phase upon which I am at present working.

The same individual does not vary more than two or three cells during the course of twenty-four hours.

Food does not seem to have any noticeable effect upon this normal figure.

Considering these facts I feel that I am justified in taking the figure 25 as an upper normal limit.

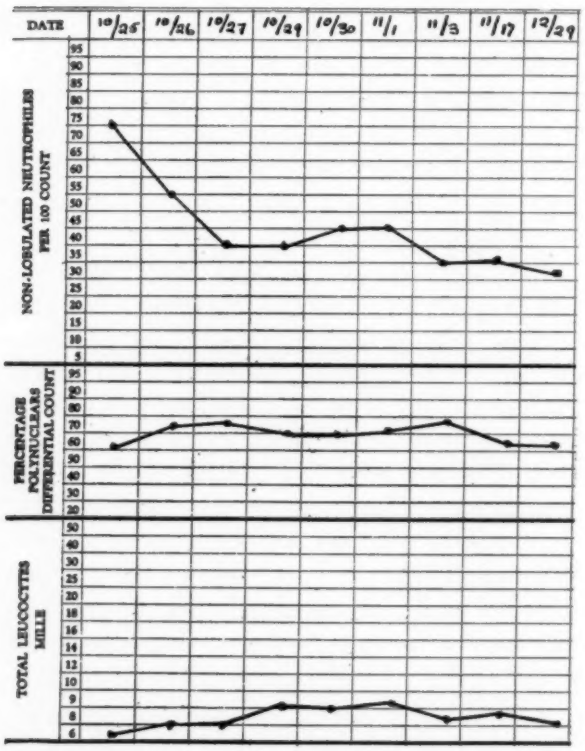

Fig. 6. Case, Miss F. Non-lobular determination done on October 25, 1926. Positive diagnosis of inflammatory condition made, confirmed later the same day by roentgen ray of chest which showed lobar pneumonia. Patient recovered.

The next problem was to determine what happened in the presence of inflammatory conditions. With this end in view I determined the non-lobular percentage of rabbits and found it to be about the same as, or slightly lower than, that in man. I then injected varying amounts of live cultures of pus-forming bacteria into the peritoneal cavity and took counts every half hour thereafter.

Figures 4 and 5 represent typical results of this experiment. From them important deductions may be drawn. First, the usual temporary leucopenia as exemplified by the drop in the total number of white cells, is clearly demonstrated. After the inflammatory process has gone on for some time, the usual rise in the percentage of polymorphonuclear neutrophiles occurs, but almost immediately after the inoculation, it will be observed the percentage of non-lobular forms commences to rise and keeps mounting until death occurs or the

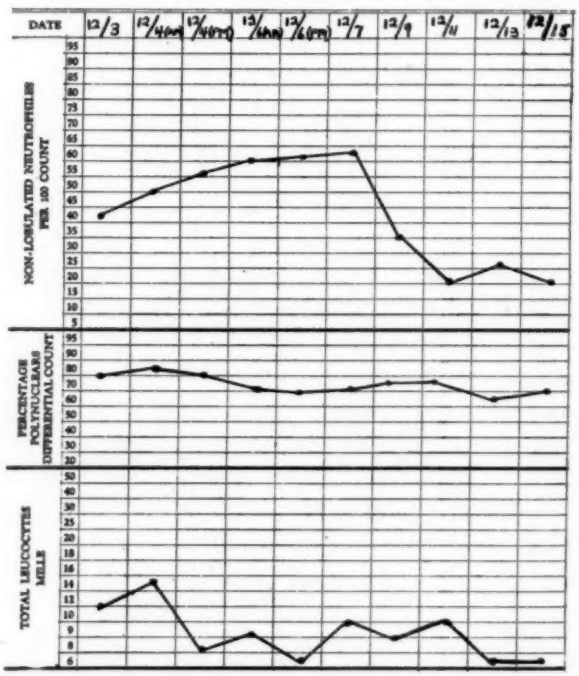

Fig. 7. Case, Mr. M. Non-lobular determination made on December 3, 4, 6, and 7, 1926, showed inflammatory process. Diagnosis confirmed at operation, acute appendicitis. Patient recovered.

inflammatory process is overcome by phagocytosis.

Feeling that the laboratory data needed clinical verification, I attempted diagnostic non-lobular determinations on cases before operation. Thus far I have not failed to make a diagnosis of inflammatory condition when one was found at operation, nor have I called any case inflammatory where operation did not verify this.

Figures 6 and 7 represent charts of two individuals which are characteristic of this series. I have at present only about fifty

cases upon which to base conclusions but in the absence of any contradictory evidence, I feel safe in making the statement that if a non-lobular determination reveals the presence of 35 per cent or more of these forms an inflammatory process is present somewhere in the body.

Since we are watching the systemic reaction to inflammatory processes, we cannot by this method of diagnosis determine where the inflammation is, hence we cannot distinguish between an acute appendicitis and pneumonia, as yet.

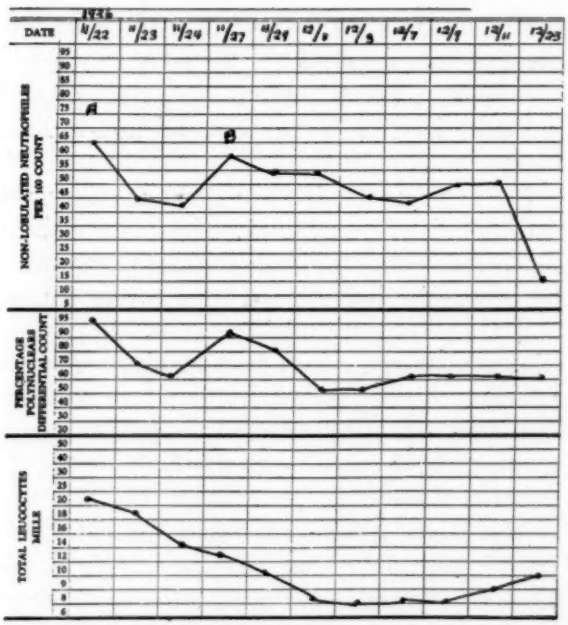

Fig. 8. Case, Mrs. H. Non-lobular determination made on November 22, showed inflammatory process. Diagnosis confirmed at operation the same day—appendiceal abscess. On November 27, abscess on anterior abdominal wall opened. Patient recovered.

Now let us consider a working theory with which to explain the foregoing observations. When the call for phagocytes comes, the white-blood-cell-forming organs pour into the circulation their available polymorphonuclear neutrophiles. These polymorphonuclear neutrophiles being of the younger variety, fall into the non-lobular group. Hence, before the total number of white cells or the percentage of polymorphonuclears has risen to the point where it is clearly indicative of an inflammatory process, a determination of the non-lobular forms present will give this desired information.

To use a simple analogy, let us assume that we are in a position to observe the front line trenches of our enemy during an engagement. Because of differences in their uniform, it is possible to distinguish the recruit from the seasoned trooper. We find that in a given sector there are normally ten thousand men, 75 per cent of which are seasoned troopers. We launch an attack against the enemy and wipe

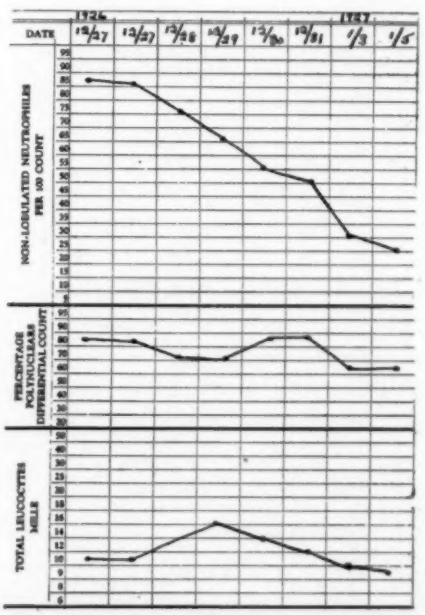

Fig. 9. Case, Mr. G. Non-lobular determination done on November 27. Diagnosis, inflammatory condition confirmed by blood culture; septicemia. Patient recovered.

out 2000 of the men. These men are replaced by bringing up 2000 reserves, among whom 50 per cent or more are recruits. The total number of men in the trench sector will remain the same but the proportion of recruits among them will have risen. As the battle progresses, if the enemy's reserves are adequately prepared and brought into action, the percentage of recruits among the men will not markedly increase and if our attack is mild enough the enemy will eventually reestablish the normal working proportion of 75:25. If, however, our attack is so vigorous that we

overtax his man power, the constant filling of his trenches with recruits will raise their proportion continually until the time may come when practically all of his men are of the more inexperienced variety. This is an extremely unscientific simile but I believe it serves to illustrate quite clearly what goes on in the peripheral circulation in the face of an inflammatory reaction.

In order to test this theory I do a non-lobular determination upon cases of inflammatory disease over a period of two or

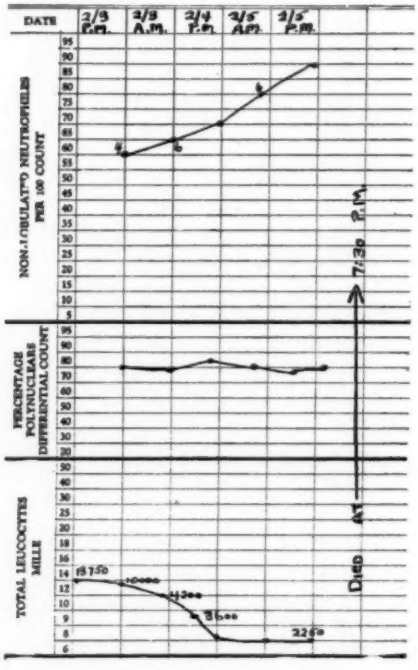

Fig. 10. Case, Mr. B. Showing results of non-lobular determination over a period of forty-eight hours following operation for drainage of peritoneal cavity due to ruptured appendix and generalized abdominal peritonitis. Death at 7.30 p. m., February 5.

three weeks, taking a count every twelve hours in some instances, and every twenty-four in others, and it has been my experience that as long as the percentage of non-lobular forms remains higher than normal or is rising, the prognosis of that case must be guarded, because it indicates that the white-blood-cell-forming organs are being severely taxed. On the other hand, if during an imflammatory process the percentage of non-lobular forms decreases, the prognosis is favorable because the reverse of the previous proposition is true. The charts clearly illustrate this point (Figs. 8, 9 and 10.)

I realize that the number of cases upon which the foregoing theory is based is small, and it is my intention to follow it along over a period of time. It is in the hope that I may receive the assistance of other workers that this article is presented now. For those who are desirous of testing these theories I suggest the advisability of establishing a normal for each set of working conditions. It is possible that climate and the amount of actinic rays in the sunlight may have some effect upon this normal figure. In a very small series of cases I have found that exposure to the Alpine sun lamp has caused a moderate increase in the percentage of non-lobular forms.

Quite recently I have been making our counts with a 1½ mm. binocular microscope and find that the same slide counted by the same individual, first under 2 mm. and then under a 1½ mm. lens will yield slightly lower figures for the higher magnification. I suggest that higher magnification is of no great advantage as such high power is not usually available for average practitioners.

To those trained in ultra-scientific research methods the foregoing article will appear elementary, possibly even crude, but I wish to call attention to the fact that if this diagnostic aid is to be of far-reaching influence it must be made available to the diagnostician who may not have facilities of a research laboratory at his disposal but carries in his armamentarium a microscope with a 2 mm. oil immersion lens.

CONCLUSIONS

A determination of the percentage of non-lobular forms among the polymorphonuclear neutrophiles in the peripheral circulation is of value because:

1. It is a classification that is simple.
2. It will give a positive diagnosis of an inflammatory disease earlier than the usual white and differential cell count.
3. The information thus gained is of

great prognostic value in following the course of an inflammatory condition.

I wish to express my thanks to the members of the Fifth Avenue Hospital Staff who have kindly allowed me to study their cases from this standpoint as well as to Dr. Jessup and Miss Pratt, the technicians and Miss Phillips, Miss McCollum and Mrs. Woese who have worked arduously with me, likewise to Mrs. Arthur Huey and Mr. L. W. Lawrence whose donations made this investigation possible.

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DIAGNOSIS OF A TUBERCULOUS KIDNEY

The most deceptive feature is the complete absence of pain in either kidney until the later stages of the disease. It is difficult to realize that one of the kidneys may be eaten up with tuberculosis although there has been no complaint of pain in that kidney. Not until disease has been present for a year or two may one of the kidneys become painful and ache. Yet the painful aching kidney may be the healthy hypertrophied one. The healthy kidney may ache because it is heavy, having increased to double its size, and because it is doing double the work. It is often difficult to persuade the practitioner and the patient that the aching kidney may be the healthy kidney.

Occasionally there is true renal colic on the side of the diseased kidney, set up by the passage of cheesy material down the ureter. Nevertheless, renal pain is usually absent, and the only common and characteristic pain is that experienced at the neck of the bladder or in the end of the penis at the finish of micturition. Accompanying this pain is the most constant symptom of all, greatly increased frequency of micturition. This increases continuously and is not usually marked by intermittence over periods of weeks or months, as is the case with increased frequency set up by other forms of chronic infections of the kidney and bladder.—Frank Kidd in *The Practitioner*.

THE TREATMENT OF ACUTE SUPPURATIVE PLEURISY IN CHILDREN*

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PECULIARITIES OF SUPPURATIVE PLEURISY IN CHILDREN

THE treatment of suppurative pleurisy in children has received but little attention from those writing on this subject, as such cases have usually been included in adult groups. There are certain features, however, that differentiate these groups, the most important of which are:

1. Thickness of chest wall.
2. Diminished power of resistance.
3. Cooperation of patient.
4. Nature's ability to repair in childhood.

1. *Thickness of Chest Wall.* In the average child suffering from suppurative pleurisy, the thinness of the chest wall, when exaggerated by emaciation, has some operative advantage.

(*a*) Diagnosis is more exact in outlining the encapsulated pocket, both by physical signs and by roentgenography and fluoroscopy.

(*b*) An underlying pneumonia is readily detected, which is of vast significance in determining the question of operation.

2. *Diminished Power of Resistance.* (*a*) Most children with suppurative pleurisy do not have enough power of resistance to withstand the shock of any severe operation, so the simplest efficient operation is demanded. Even the shock of dressing the wound is vitally significant, and particularly so during the first few days after operation. In these cases it is of the greatest importance to use simple tubes that are held in place in a position that does not irritate, and yet are effective.

(*b*) In very young children suffering from suppurative pleurisy, where mortality is exceptionally high, forced feeding before and after operation is often necessary. When these children, who refuse food, are gavaged, regurgitation follows. This occurs in very sick patients whose emaciation would indicate a long period of starvation. Apparently during their primary disease, when feeding is difficult, their stomachs contract. This contraction is overcome by frequent feedings of small amounts which are gradually increased in quantity. This treatment requires constant nursing, but it is the means of saving life.

With the exception of the first few days after operation, it rarely is necessary to urge eating, as a properly drained empyema patient will consume large quantities of food. The dietary must be of high caloric value and the food should be given in as great a quantity as the child's gastrointestinal tract will assimilate. The reasons for requiring so much food are: to overcome loss of weight due to the emaciation which obtained during the primary disease and the formative period of the suppurative pleurisy; to overcome the negative nitrogen balance that is always present in underfed suppurative pleurisy cases; and to supply warmth to overcome the extra loss of heat that is concomitant with an open pneumothorax.

3. *Cooperation of the Child.* This is necessary and can be obtained by some simple device such as a toy balloon used in place of the customary blow-bottle.

To prevent spinal curvature, which is

* Read in part before the Section of Surgery, New York Academy of Medicine, February 4, 1927. An abstract of this paper, and the discussions, were published with the Transactions of that meeting in THE AMERICAN JOURNAL OF SURGERY, May, 1927.

likely to occur, get the child out of bed as early as possible. Encourage him to run until short of breath, which will create deeper breathing with greater expansion and better drainage. Exercise in any form is particularly desirable. Balcony sunlight treatment, after acute symptoms have subsided, is of great value. The average child will cooperate, so this may be carried on even in mid-winter.

In children the reaction to exposure is very noticeable and it is out of all proportion to that of adults. It is most vital directly after operation and for the next four to six days. The percentage of complications is very much higher in windy winter months, which is due to exposure to cold and prevalent infections.

4. *Nature's Ability to Repair in Childhood.* In suppurative pleurisy, as in many other diseases of children, growth is a great adjunct to the final result. If there is a curvature or a flattening of the chest or incomplete expansion of the lung this fault will be gradually overcome as the child develops.

The management of suppurative pleurisy is based on possibilities and directed by probabilities. The plan of treatment should fulfill the following requirements and, in so far as it yields good results, must be accepted as satisfactory:

1. Proper treatment of the primary disease with early recognition of the suppurative pleurisy.
2. Low mortality.
3. Minimum anatomical and physiological deformity.
4. Prevention of complications.
5. Early restoration to health.

In comparing treatment of suppurative pleurisy by different surgeons, with that of a suppurative process in the peritoneal cavity as, for instance, suppurative appendicitis, we are forced to the conclusion that there are still worlds to conquer in the realm of suppurative pleurisy.

Practically all agree on the general plan of treating suppurative appendicitis, but only in a few general principles are surgeons agreed in the treatment of suppurative pleurisy. All believe in the dictum of "where there is pus, let it out." However, the time to act; the amount of pus to be removed at the operation; the method of attack, whether by rib resection, simple thoracotomy, exploratory thoracotomy, with removal of foreign substance (congealed fibrin); the method of drainage, whether by the closed suction method, syphon drainage, double drainage, through and through drainage tubes; aspiration with injection of bactericidal agents; the placing of Dakin tubes in the cavity so all parts may be irrigated and disinfected; these are a few points on which we are not fully in accord.

Every writer wishes to impress the fact that prevention of chronic empyema is one of our chief aims; yet we all continue to operate on chronic suppurative pleurisy, and we believe that a certain percentage, varying with the particular pathology, will continue to develop chronic suppurative pleurisy. In other words, it is the particular type of suppurative pleurisy rather than the particular type of operation that is the determining factor.

COMPLICATIONS CAUSING CHRONICITY

Many of the complications that prevent closure of the chest wall, such as osteomyelitis of rib, inadequate drainage, foreign bodies and multiple pockets can be controlled by adequate surgery. A few, however, will develop a chronic form in spite of the management of the acute. We refer particularly to those cases with (1) large bronchopulmonary fistulae; (2) interstitial changes in the pulmonary parenchyma; (3) multiple septic foci in the lung which apparently, from time to time, rupture through the visceral pleura and reinfect the cavity; (4) primary tuberculosis or a secondary infection with tuberculosis.

The pathology of suppurative pleurisy does not come within the scope of this paper and will be referred to only by statements of accepted ideas, insofar as

it is inseparable from a discussion of treatment.

1. With the use of Dakin solution we frequently find a more or less sudden appearance of a *bronchopulmonary fistula.* At first we thought that the solution had eroded a spot of partially devitalized lung tissue. A more probable explanation is that the fistula developed during the course of the disease but had been temporarily closed by the thick layer of fibrin that adhered to the visceral pleura. When this became detached the fistula suddenly appeared. This is illustrated by the following case:

Case 1 (234 D-4). A child of two years, in whose case the regular two-hourly Dakin's irrigation was not used but the wound was daily irrigated at the time of dressing. This was without ill-effect for several days. Later, when the solution was introduced, the patient became "gassed" on account of the opening of a fair-sized bronchus. There was a severe paroxysm of coughing; the child strangled, became cyanotic and developed marked shock from which it did not recover. Death is very uncommon from such a cause.

Small pulmonary communications close spontaneously and are not a cause of chronicity. For instance, in doing a decortication, the parenchyma is invariably damaged enough to cause bubbles to appear. If irrigation is started at once the patient becomes "gassed," but in three to six days after operation it is perfectly safe to institute this treatment.

When a large bronchus communicates with the pleural cavity it will not close spontaneously. This is illustrated by the following case:

Case 11 (299 D-4). A boy, aged six years, suffering from post-tonsillectomy pneumonia, who did not recover in the usual time, developed signs of fluid in the chest. A roentgenogram confirmed this diagnosis and an exploratory puncture revealed pus. The operation showed that a lung abscess had spontaneously ruptured into the pleural cavity, producing an encysted suppurative pleurisy. This wound had every advantage for spontaneous closure but resisted all efforts and developed a chronic state. It, of course, rightfully belongs in the class of lung abscesses, but with its resulting bronchopulmonary fistula it serves to illustrate in a magnified way the fact that when the pleural cavity communicates with lung parenchyma it will not spontaneously heal if that communication is of any appreciable size.

Thus we have two extremes: first, where chronicity is practically unavoidable; second, where the openings are small in collapsible tissue with spontaneous closure. The determining factor is the size and location of the communication. I am convinced that certain cases do not have such an easily demonstrable pathologic process which undoubtedly accounts for our failure to prevent chronic suppurative pleurisy.

2. *Interstitial Changes in the Pulmonary Parenchyma.* There are few cases in which the lung will not expand. In these cases the roentgenogram shows marked changes in the parenchyma together with thickening of the pleura. When decortication is done the lung does not expand in the usual manner. There is an accompanying bronchitis, and the sputum is persistently negative for tubercle bacilli. By prolonged Dakinization the chest wound finally closes leaving an apparently sterile pneumothorax.

Case 111 (365 D-4). A girl, two years old, who had thickening of the pleura and some interstitial changes in the lung. Her condition was not good enough to warrant an exploratory thoracotomy with decortication of the lung. This patient was thoroughly Dakinized until smears from the cavity showed few organisms and her chest wound was allowed to close. However, she continued to show an unexplained temperature elevation. The pneumothorax was sterile so the temperature was due to other causes. Gradually it subsided and the pneumothorax disappeared. It took about six months for the lung to expand completely and fill the chest. Eventually the pleural thickening disappeared.

In some other cases the pneumothorax did not become obliterated, due to the marked interstitial changes in the lung

parenchyma and recurrence in such cases is inevitable.

Case IV (304 D-4). A boy, aged eight years, was admitted on April 16, 1921, to the Pediatric Service, Bellevue Hospital, with pneumonia; on May 9 a thoracotomy was done, fifty ounces of pus were removed and a colon bacillus was recovered. This case ran a very unsatisfactory course with elevations of temperature, considerable cough and expectoration. The sputum was negative for tubercle bacilli. The chest wound ultimately closed after prolonged Dakinization with a small pneumothorax persisting, and the patient was sent to the country July 19. On July 29, he was readmitted to the hospital with fever. Roentgen-ray examination showed a small effusion in the lower portion of the right pleural cavity and a thickening of the pleura. The wound was opened, considerable pus was evacuated, the cavity was Dakinized. On August 28, the patient was again discharged in good condition with the wound closed. On September 23, he was again readmitted and a roentgen-ray examination showed a small collection of air in the right pleural cavity, also fibrosis of the right lower lobe with marked thickening of the pleura. On September 29, exploratory thoracotomy revealed a small amount of pus with marked thickening of the pleura. This patient cooperated and every effort to expand the lung was made. On October 12, he was discharged for the third time. Roentgenograms then showed no pneumothorax, but did show interstitial lung changes. Physical examination suggested a bronchiectasis. On June 16, 1922, he was again readmitted. A sinus was found at the site of the scar and a further roentgen-ray study revealed more interstitial changes in the right lower lobe. An exploratory thoracotomy showed a small pneumothorax but no loculi of pus. This wound eventually healed and the patient has remained well to the present time. This case, which received routine care in dealing with acute suppurative pleurisy, developed chronic suppurative pleurisy, due to the lung having lost its ability to expand properly and to fill completely the pleural cavity.

3. *Multiple Septic Foci in the Lung Which Rupture and Reinfect the Pleural Cavity.*

Case V (1558 D-4). A boy two and a half years of age, admitted January 24, 1921, to the Pediatric Service, Bellevue Hospital, with lobar pneumonia of the upper left lobe. This patient developed a suppurtive pleurisy and was operated on March 3. A moderate amount of pus was evacuated and the culture showed pneumococci. In eighteen days the wound had entirely healed and the lung fully expanded. One week later he was transferred to the medical service with pneumonia of the right lung and on April 14 he was returned to the surgical service and operated on the left side (recurrent suppurative pleurisy); a large amount of pus was found and a culture again revealed pneumococci. Following the operation for recurrence, this patient had a stormy career. He would have periods of normal temperature, take food readily, respond to blood transfusions and encourage us to believe him on the road to recovery. This was followed by periods of reinfection and the wound again discharged profusely. He had a poor appetite and fever. The pleura was so thick that physical, roentgenographic and fluoroscopic examinations were decidedly unsatisfactory from a diagnostic point of view.

The condition of the patient did not warrant an exploratory thoracotomy but it was hoped he would eventually reach a stage of being a reasonable operative risk. It was suspected that this patient had multiple loculi or subpleural abscesses, which continued to develop. One month after operation for recurrence, a pocket of pus was found at the level of the left fourth interspace anterior to axillary line. This was drained by an additional incision as it had no communication with the former pocket. Pneumococci again appeared in the culture. The original incision in the seventh space was still open but draining a very small amount of thin seropus. The patient continued an up-and-down course for two months, repeated transfusions keeping up his constantly declining vitality. No definite evidence of further developing loculi could be diagnosticated.

The case eventually terminated by the development of an acute nephritis with marked general anasarca. Fortunately, an autopsy was performed. A partial protocol follows: On opening the pleural cavity, the left lung was found to be partially collapsed. The pleural cavity on the left side showed both surgical incisions to be wide open and there was good drainage so there was no pus in the chest cavity. The lung was firmly bound to the

chest wall in the upper and posterior portions. On removing the lung, the pleura was found to be markedly thickened. On section, the lung was dark red in color and studded throughout by numerous abscesses varying in size from one-fourth to one-eighth of an inch. The right lung was firmly bound to the chest wall throughout its entire extent by numerous adhesions. The pleura over this lung also was markedly thickened. The other organs were practically negative except the kidneys which showed an acute nephritis.

This was an extremely interesting case and was followed closely from the beginning of the illness to its termination. Had this child not developed a terminal nephritis he would have developed a chronic suppurative pleurisy, and from a cause that surgery was helpless to prevent.

4. *A tuberculous infection as a cause of chronicity* is illustrated by:

Case VI (308 D-4). A boy, aged eight years, admitted February 14, 1922, to the Pediatric Service with bronchopneumonia. He was transferred to the surgical division and roentgen-ray and physical examination revealed an encapsulated suppurative pleurisy. He was operated upon February 20. An intercostal incision was made and a large quantity of pus containing pneumococci, group I, was evacuated. Considering his long period of severe illness the patient was in good condition. There was no apparent reason why he should not have recovered promptly, especially as he was at an age where statistics show a favorable prognosis. Thirty days after the operation there was no discharge. The drainage tube was discontinued and the wound closed. Three days later he developed a rise of temperature and the tube was reinserted. This had to be repeated several times. Each time we believed the chest would permanently close. Roentgenograms and fluoroscopic examination did not reveal the cause of this condition. Eventually an exploratory thoracotomy revealed a small cavity that was being drained by the original incision, no undrained loculi were found. We did a partial decortication of the lung by criss-cross incision and blunt dissection of the thickened pleura. The lung then expanded and filled the pleural cavity.

A specimen of pleura removed at operation did not show it to be tuberculous, nor did a specimen taken one month later. However, the wound refused to heal although there was practically no cavity. A probe was passed far into the chest and an endoscopy showed the sinus to run along the posterior gutter toward the apex. An examination of the granulation tissue showed it to be tuberculous. Although two subsequent operations were done, this case drifted into the chronic class and has a discharging sinus at the present time.

Whether this was a primary tuberculosis or, what is more likely, a tuberculosis grafted upon a pneumococcus suppurative pleurisy, it is impossible to determine.

The case just cited presents a condition very difficult to control. This patient has been given recognized surgical treatment combined with quartz lamp therapy and the best hygienic care. He has remained in fair physical condition, but still has a small draining sinus.

TREATMENT

Our general plan is as follows:

In the formative stage, if there is distress, repeat aspiration as often as necessary. In a few instances, in streptococcus cases, where the reaccumulation of pus is very rapid, the air-tight syphon drainage or suction method is used, but this is not entirely satisfactory; repeated aspiration is the better plan.

When the fluid is frank pus and, as is often the case, the temperature from the pneumonia has abated, open drainage is instituted.

Intercostal drainage with the so-called "flapper tube" is the method used. A "flapper tube" is made by fitting a glove finger (one that has been softened by repeated sterilization) on the distal end of a fenestrated rubber tube as a projection, the tube having been cut with a sixty degree bevel, forming a valve that readily allows fluid and air to escape with expiration but closes with inspiration. This is an aid in lung expansion as it tends to restore the negative intrapleural pressure, and is of use in irrigating at the time of dressing as it forms a funnel through which irrigating fluid is passed into the chest cavity. This principle of valve action

is mentioned by various authors. Mathews speaks of it when he shows how the tissues tend to fall together and form a valve, which is aided by a dressing that is wet from drainage.

The same principle is used by Soresi,[1] who employs a metal tube with a rubber flapper valve. Mechanically, it is a more perfect valve, and it has the advantage of a projecting nipple which can be attached to a bottle by means of a rubber connecting tube thus keeping the dressing clean and avoiding the trauma of redressing. This is of distinct advantage in very sick patients, especially for the first few days after operation. It has also a distinct advantage over the Kenyon syphonage in that the patient is not anchored to the bottle, but the bottle to the patient, making it possible for free movement in any desired position.

The operation for suppurative pleurisy is always done with local anesthesia. The patient, if not too sick, is allowed to sit up; cooperation is more likely to be had with him in this position.

By preference a small incision is made in the seventh intercostal space near the mid-axillary line although the site of the incision naturally varies with the location of the pus. A "flapper tube" is introduced and the pus is allowed to run out. The tube is held in place by one silkworm gut stitch. At no time have there been disturbing symptoms caused by completely evacuating the cavity at operation.

Of course dressings become saturated the first few days after operation and must be changed frequently. At this stage the syphon drainage is much cleaner and easier for the surgeon, but the patient is not as comfortable, nor does his wound drain as efficiently. Irritation is started in the next few days, the exact time depending on the condition of the patient and the amount and the character of the drainage. Usually on the fourth day the cavity is irrigated, the patient reclining with wound uppermost. Saline solution is introduced through the "flapper tube," the measured amount determining the size of the cavity. If no coughing is produced, Dakin's solution is then used cautiously. If there is no "gassing," the cavity is daily cleansed by thorough irrigation with Dakin's solution. This daily irrigation is not an attempt to sterilize the cavity, but is sufficient to keep thin and deodorize the discharge. Our experience with more complete Dakinization has been quite similar to that reported by many others. Even under ideal conditions it has not materially shortened the time for complete closure of the wound.

This simple procedure has effected a cure in about eighty per cent of our cases. The time of hospitalization ranges from fifteen to fifty days. None of the patients in this series was discharged while dressings were necessary. By this many recurrences were prevented.

When, judged by temperature, appetite, type of discharge and general condition, it is found that the patient has not materially improved at the end of eight or ten days, and there is no acute otitis media or recurrence of pneumonic process, we conclude that we are dealing with a complicated form of suppurative pleurisy, such as multiple loculi or a markedly thickened pleura, preventing complete drainage. Then an exploratory thoracotomy is done.

The patients are especially prepared for this operation; if anemic, they are transfused. As a routine measure they are partially digitalized.

Under light ether or gas anesthesia, an intercostal incision is made long enough to give proper exposure, and a rib spreader is introduced. If more exposure is required, a rib may be cut at one or both ends and telescoped. This gives the advantage of visual guidance for dividing the vicious adhesions, doing a partial decortication or any other procedure necessary, thus converting multiple loculi into a single cavity,

[1] Soresi, A. L. Correct conception of thoracic empyema and its rational physiological treatment. *Med. J. & Rec.*, cxxi, 460-465; 524-527. Late results in empyema thoracis in children operated on by the author's method. Am. J. Surg., 1926, n.s. i, 68.

or placing drainage where it is needed. This may appear to be radical surgery but, properly done, it produces little shock, reduces mortality, shortens convalescence and causes no deformity.

In our series this has been done in twenty-five cases with only one mortality. This patient was a small colored boy with 4-plus Wassermann reaction. Transfusion was not available. The wound broke down, causing a large open pneumothorax, which would not heal. He died twelve days after operation.

The statement has been made that a lung expands because negative pressure in the pleural cavity compels it to expand. That the negative pressure plays a part is not denied, but it is only a minor part. The most potent factor is the intratracheal pressure, which is transmitted to the lung tissue. This is easily demonstrated. For instance, when doing an exploratory thoracotomy with the pleural cavity fully exposed, we see the lung expand and contract. Furthermore, in doing a decortication, the lung expands under vision, and if the patient is allowed to cough when only partially decorticated, there is danger of the lung herniating through the incision in the thickened pleura. All this in the presence of an atmospheric pressure. That the lung does not expand in the presence of a pneumothorax or positive pressure in a closed pleural cavity is, of course, axiomatic. A lung expands more easily in the presence of a negative pressure although it expands to a surprising degree in atmospheric pressure provided there is an opening sufficently large for the easy and quick exit of air contained within the cavity.

I am convinced that the important factor in curing a suppurative pleurisy is lung expansion and that the element obstructing lung expansion is usually a thickened pleura. Therefore, any treatment that will prevent or, when once established, remove a thickened, unyielding pleura will hasten lung expansion, and following this, closure of the chest.

PROGNOSIS

It is very difficult to make a classification of suppurative pleurisy cases, but for clinical purposes they may be divided into three groups.

1. Cases having good prognosis.
2. Cases having poor prognosis.
3. A middle group whose prognosis is largely dependent upon the kind of treatment received.

1. *Good Prognosis.* In this clinical grouping about forty per cent of the patients come under the heading of good prognosis. By this is meant that the patient has inherited a healthy constitution, has been surrounded by fair conditions during health, the primary disease was promptly and properly diagnosed and treated, and developed encapsulated suppurative pleurisy, which in turn was promptly diagnosed and received proper care during the formative period of the disease. Such patients will recover if they are given adequate drainage by any of the methods advocated. The period of invalidism will be minimum. The type of organism is a minor matter. Recovery statistics in this group are very gratifying.

2. *Poor Prognosis.* In this group, our series at Bellevue Hospital shows about twenty-five per cent. Through the Social Service Department, we have found living conditions bad, unhealthy parents, dirty unsanitary homes, under-feeding and exposure. Rickets is almost universal. Add to this background a virulent infection, the primary disease improperly diagnosed, a starvation diet, and the child sent to the hospital only when in extreme condition. Such cases, with an encapsulated suppurative pleurisy, will often do surprisingly well if given adequate drainage and plenty of food. But in a patient with a virulent infection with complicated pleural involvement, or one who has already developed complications such as acute otitis media, or pneumonia of the opposite lung, the prognosis is universally bad regardless of the type of operative procedure.

3. *Middle Group where Prognosis is much Dependent upon Surgical Procedure.* The remaining thirty-five per cent fall in this group. In this class, where the background has been only fair, the treatment of the primary disease good, but the infection virulent, the surgical treatment largely determines the ultimate outcome.

The order of treatment in suppurative pleurisy is, first, adequate drainage; second, skillful nursing and high caloric diet; third, blood transfusion. The latter requires a specialist; not mere technique, as that can be easily mastered, but careful judgment is required in determining when and how much blood should be given. It is more difficult to determine these points in children than in adults.

Only whole blood, is given and by the Lindemann method. With whole blood, accurately matched and given in proper amounts reactions are seldom seen. The circulating fluid is quickly brought up to the standard and it acts as an efficient tonic, which makes it possible to take greater amounts of food and in turn metabolize it. This is a most important factor in recovery.

In any case of secondary operation, it is our routine to give a preliminary transfusion. We have found it an excellent prophylactic measure, and without doubt, it has been the determining factor in many cases and has shortened the period of convalescence in many more.

In this series fifty cases were transfused, many having two or more transfusions. Had donors been available many more would have received the same treatment.

The greatest number of transfusions to be given any one case, was fourteen. It was an interesting case to follow. Blood transfusion was the therapy that prolonged life and made recovery almost in sight, even in this septic case. Following each transfusion the patient took more food and showed marked signs of improvement, but could not overcome the infection and died four months later.

MORTALITIES

A statistical analysis has not been the aim of this paper, but to determine the results of the above outline of treatment, a few statistics are here presented.

		No.	Died	Cured	Mortality per cent
	1920				
Age	0– 2	15	5	10	33⅓
	2– 6	19	2	17	10⅓
	6–12	10	0	10	0
Total		44	7	37	15.9
	1921				
Age	0– 2	7	3	4	42
	2– 6	16	2	14	12½
	6–12	7	1	6	14
Total		30	6	24	20
	1922				
Age	0– 2	9	3	6	33⅓
	2– 6	16	1	15	6¼
	6–12	7	0	7	0
Total		32	4	28	12½
	1923				
Age	0– 2	2	0	2	0
	2– 6	10	2	8	20
	6–12	3	0	3	0
Total		15	2	13	13.3
	1924				
Age	0– 2	15	6	9	40
	2– 6	12	1	11	8.3
	6–12	6	0	6	0
Total		33	7	26	16⅓
Total for series		154	26	128	16.8

A glance at this table shows readily the fallacy of conclusions drawn from a small number of cases during a short period of time. Thus in 1923 the mortality in infants was nil, while in 1924 it was 40 per cent. For the entire time extending over five consecutive years it was 35.4 per cent. The number of infant cases was forty-eight, the exact number also reported by Ladd and Cutler,[1] with the same percentage of mortality.

The mortality for the entire group as shown in the table is 16.8 per cent. This is somewhat higher than expected, due to

[1] Ladd, W. E., and Cutler, G. D. Mortality from empyema in children. *Surg., Gynec. & Obst.*, 1924, xxxix, 429–431.

the large number of infants in the series. The mortality excluding infants (106 cases with 9 deaths) is 8.49 per cent; in the group from two to six years (73 cases with 8 deaths) is 10.9 per cent; and in the group from six to twelve years, which is universally found to be the lowest of any age (33 cases with 1 death) 3.3 per cent.

In computing these statistics, only cases that were operated upon were included. In the total number of deaths (34) unfortunately only a few autopsies could be obtained. Consequently it was impossible to determine the exact cause of death in each case.

Of these fatal cases:

One died suddenly during convalescence, evidently from an embolus.

One went into severe shock from "gassing" while being irrigated with Dakin's solution, and did not recover.

In one whose chest was still draining but had no retention, a generalized peritonitis was discovered post mortem, but no foci of the peritoneal infection were found.

Two cases had severe nephritis with marked anasarca.

One had cerebrospinal meningitis.

One died six hours after blood transfusion, there being severe shock induced by the transfusion.

One had pneumonia of the opposite side, followed by suppurative pleurisy on that side.

One had severe laryngeal diphtheria.

One had cellulitis of the arm.

One had osteomyelitis of the tibia.

Five had pneumonia of the opposite side.

Ten had acute otitis media.

In all of these cases severe toxemia was the picture presented, and this was the real cause of death, either from the suppurative pleurisy or from the complications.

SUMMARY

1. The treatment of acute suppurative pleurisy in children differs from that in the case of adults.

2. High calory diet is an essential to overcome negative nitrogen balance.

3. Repeated aspiration during formative stage for relief of distress is advised.

4. Intercostal incision and drainage is a method of choice.

5. Only local anesthesia should be used.

6. A "flapper tube" aids materially in lung expansion.

7. Blood transfusions are of great value.

8. A few cases will inevitably develop a chronic form.

9. Exercise for lung expansion is of great importance.

OBSTRUCTIVE LESIONS
INVOLVING THE VESICAL OUTLET

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THE subject of obstructive uropathy is intimately linked with problems involved in the field of internal medicine, making it one of paramount importance not only to the urologist but more particularly to the internist. The clinical significance of this problem has been and still is considerably overlooked by the average practitioner. For this reason, it is believed that a brief résumé of the more common conditions encountered by the urologist might stimulate interest in this very important subject.

Obstructive lesions of the urogenital tract are conveniently divided into two groups, supravesical and infravesical. Discussion will be confined to the latter group and especially to those lesions occurring in the immediate region of the vesical outlet.

TYPES OF LESIONS

1. Hypertrophy of the prostate.
2. Median bars and contractures of the vesical neck.
3. Trigonal hypertrophies and Mercier's bars.
4. Congenital lesions about the vesical orifice.
5. Neoplasms, stones, and foreign bodies in the prostatic urethra.
6. Spasms of external vesical sphincter.
7. Bladder neoplasms and diverticula obstructing the vesical outlet.
8. Retroperitoneal tumors.

PATHOGENESIS

For a clear understanding of the pathogenesis it is necessary to regard the urinary apparatus as a single tubular system with the bladder suspended between the renal cortex and the meatus urinarius. Accepting this conception of the urinary system, it is easy to understand why an infravesical obstruction, whether in an old man, due to an hypertrophied prostate or in a child, due to a vesical neck contracture, directs strain first upon the bladder. This organ, like the heart, responds to the increased work by undergoing hypertrophy. In fact the brunt of the attack being first thrown upon the bladder, leaves the kidneys entirely unaffected. Should the obstructive lesion be permitted to continue, however, the resistance to the free flow of urine from the bladder increases to such a degree that its compensatory mechanism soon fails and the assault is promptly transmitted to the ureters, and thence to the kidneys, the final outcome being decompensation and dilatation with resultant hydronephrosis. Whether the hydronephrotic changes will be unilateral or bilateral will depend upon the type of obstruction; an infravesical obstruction leading to bilateral changes, a supravesical one to unilateral hydronephrosis.

To make a diagnosis of hydronephrosis or pyonephrosis, and to direct treatment toward such conditions before ascertaining the causative agent, is to commit a grave and often fatal blunder. The diagnosis of hydronephrosis makes it incumbent upon the clinician to locate the obstruction. It is of even greater importance to know that a patient with an obstructive uropathy, if subjected to a careful examination, will invariably show unmistakable evidence of renal insufficiency long before the kidneys have become hydronephrotic. It is often impossible to differentiate by ordinary laboratory or clinical procedures the symptom-complex caused by obstructive lesions from that due to chronic nephritis or Bright's disease. A correct diagnosis

can be made only by means of a careful and thorough local examination. The reason for this is that in both conditions the symptoms, being due to impairment of the normal excretory powers of the kidneys, naturally fit into the complex called uremia. It is, of course, possible for a chronic nephritis to coexist with an obstructive urinary lesion. In this event, a differential diagnosis is made possible by establishing free urinary drainage, placing the patient under careful observation, and then ascertaining the degree of renal impairment due to the obstruction and that due to permanent structural changes within the renal parenchyma. In the purely functional disturbances caused by obstructive lesions, complete restitution to normal will invariably follow the removal of the obstruction, providing of course that no permanent structural alterations within the parenchyma have occurred. When such changes do occur they are due to infection or to hydronephrosis, resulting from back pressure. To avoid error, therefore, one could with great advantage follow the rule of eliminating the possibility of obstruction in all cases presenting the clinical picture of uremia. This rule holds good especially in men past forty-five years of age.

Symptoms. Uremia is too well known to warrant a detailed description of its symptomatology. A brief résumé of its chief characteristics might aid in recalling the picture. It is not necessary for one to behold an elderly man with dry tongue, foul breath, thirst, anorexia, headache and possibly dyspnea; nor to see a drowsy individual with edema of the legs who is hiccoughing or vomiting, and suffering from bloody diarrhea to make the diagnosis of uremia. A combination of only a few of these symptoms should be sufficient to arouse suspicions of some degree of renal impairment.

Should the patient be a man past middle age it becomes incumbent upon the physician to decide whether or not he is dealing with a case of renal insufficiency due to an obstructing lesion. This is especially true when the man in addition to giving systemic symptoms indicative of uremia also complains of increased frequency of urination, with hesitancy and stoppage of the stream. How very simple it is to have the patient void and then to introduce a catheter into the bladder and determine the amount of residuum. The finding of residual urine is conclusive evidence in itself of a failure in compensation of the vesical mechanism, due always to a lesion at or below the vesical outlet. It is a procedure that can be carried out by any physician in the office or at the bedside without the slightest trouble. The next step is to determine the character of the obstruction, which can often be accomplished by a simple rectal examination, especially when the cause is an enlarged prostate. It is indeed difficult to understand why a rectal examination is often left for the consultant, when it should constitute as important a step in the physical examination as the examination of the pupillary reflex or the auscultation of the heart.

Assuming that rectal examination reveals no enlargement of the prostate, then cystoscopy is called for to determine the exact nature of the obstruction. A simple observation cystoscopy is all that is necessary to clinch the diagnosis. In the first place, the finding of trabeculations in the bladder with or without cellules indicates peripheral resistance. It means that the bladder musculature has hypertrophied as a result of increased effort to overcome the added resistance to the free flow of urine. For anyone familiar with the interpretation of cystoscopic pictures it is an easy matter to detect a tumor, a stone, an obstructing prostate, or the mouth of a diverticulum, thereby determining the true nature of the obstructing lesion.

Laboratory methods have become so simplified, especially in the field of urology, that no physician is justified in omitting them in cases of nephritis. The phenolsulphonphthalein renal function test, so

simple in its execution, if it were employed in all cases of suspected uremia would eliminate many errors in diagnosis. A blood chemistry determination today is to be had in every city, town or hamlet possessing a hospital or laboratory; and certainly it is within the capabilities of any physician to do a careful urinalysis and urea determination. If the above examinations were routinely employed when examining a suspect, it would become a relatively easy matter to determine whether the patient is suffering from some type of renal impairment.

After establishing this fact, it becomes necessary to determine whether the renal insufficiency is due to parenchymatous changes within the kidney or to an obstructive lesion somewhere in the lower urinary tract. The important triad of symptoms—pain, hematuria and tumor—is sufficient to bring to mind the picture of hydronephrosis. A rapid and continuous dripping of clear urine of diminished 'phthalein concentration through a catheter introduced into the kidney, is additional evidence of dilatation of the renal pelvis. For refinement in diagnosis pyelography may be resorted to. Should the pyelogram present clubbing of the minor calyces with or without dilatation of the pelvis, the diagnosis of hydronephrosis is clinched, since these findings are absolutely pathognomonic of the condition.

Differential Diagnosis

Hypertropby of the Prostate. Enlargement of the prostate, most frequently due to adenomata within the gland, is of itself of little importance. It is only when the gland encroaches upon and compromises the lumen of the urethra or vesical outlet, that it assumes grave significance, because of its detrimental effect upon the kidneys. In other words, the obstruction results from the intrusion of the enlarged lateral lobes into the prostatic urethra or from the valve-like action of an enlarged middle lobe upon the vesical outlet. The advanced age of the patient, the history of increasing hesitancy, frequency, nocturia and possibly dribbling, associated with the typical cystoscopic picture, suffice to make the diagnosis simple. The finding of an enlarged prostate by rectal examination is corroborative evidence. Its absence, however, does not militate against the diagnosis of hypertrophy of the prostate since the enlargement can be entirely confined to the bladder and urethra.

Median Bars and Contractures. These lesions, while not as frequent as prostatic hypertrophies, are yet sufficiently often encountered and so often overlooked that they constitute important entities in urological diagnosis. The median bar is a ridge-like thickening of the floor of the internal sphincter. The contracture is a similar thickening involving the entire sphincter. Both of these conditions are stages in one process, namely a chronic inflammatory lesion usually originating in the prostate and secondarily invading the entire internal sphincter and prostatic urethra.

Unlike hypertrophied prostates these lesions are usually seen in younger men.

Fig. 1. Pear-shaped calculus lying in the mouth of the vesical outlet causing obstruction.

The symptoms, however, very closely mimic those due to enlarged prostates. A correct diagnosis is made by the cystoscope. Instead of lateral prostatic lobes intruding into the urethra or the lid-like middle lobe projecting over the floor of the sphincter, one sees a ridge-like elevation extending from the floor of the sphincter and a recession of the supramontane urethra. In the fully developed contracture cases the vice-like grip upon the cystoscope is diagnostic.

There are two types of alterations in the trigone capable of giving obstructive symptoms. Mercier's bar and the undermined trigone. Mercier's bar is a thickening of the interureteric line which appears through the cystoscope as a thickened ridge extending between the two ureteral orifices. The undermined trigone or, as it is also called, the dissected type of trigone, appears as an oblique plane lying on the floor of the bladder with a well-developed pouch of bladder behind it. Both types can give

Fig. 2. Cystogram, showing an enormous dilatation of bladder in a boy twelve years of age with contracture of the vesical outlet. Patient referred for treatment for nocturnal enuresis.

Fig. 3. Cystogram showing small diverticula and cellules in a woman with cerebrospinal syphilis.

Trigonal Hypertrophy and Mercier's Bars. These conditions have been fully and beautifully described by Young, Hinman and others. The trigone is nothing more than a fan-shaped muscle which can properly be considered as an extension from the ureteral musculature, extending over the floor of the internal sphincter of the bladder, and attached to a point just above the apex of the verumontanum. The various pathological forms which the trigone can assume are always dependent upon lesions in the ureters or urethra. rise to definite and marked obstruction about the vesical outlet, with symptoms no different from those caused by an enlarged prostate or a median bar. The cystoscope alone makes the diagnosis.

Congenital Lesions about the Vesical Orifice. In discussing the congenital types of obstructive lesions about the vesical outlet, it is to be noted that a great diversity of opinion exists among various observers regarding the nature of the lesions. Beer, for example, maintains that the most frequent type of obstruction encountered in children is contracture of the outlet due, as he believes, to a dysfunction between

the detrusor muscle and the internal sphincter. As a result of this there occurs a spasm of the outlet followed by fibrosis. Bugbee, on the other hand, is of the opinion that hypertrophy of the verumontanum and valves in the prostatic urethra frequently cause obstruction. Whatever the nature of the obstruction may be, the outstanding features are the presence of a distended bladder and the finding of a large amount of residuum following micturition. Cystoscopy readily discloses the true nature of the obstruction. The difficulty encountered here is to convince the physician that cystoscopy in infants and children is at times as much indicated to make a diagnosis as it is in adults. To omit the use of this diagnostic aid in children is to deprive them of an indispensable and often the sole means of making a correct diagnosis. It is, indeed, unfortunate to permit children to reach the stage of hydronephrosis before recognizing the obstructive lesion responsible for it.

Tumors, Stones and Foreign Bodies in the Prostatic Urethra. This subject requires but a passing remark since its relation to the topic of discussion is so obvious. A combination of cystoscopy and roentgenography makes the diagnosis of these lesions quite simple.

Spasms of the External Sphincter. The neurologist will readily attest to the frequency of obstructive lesions in the urogenital tract due to lesions in the brain or spinal cord. To understand this problem it might be worth a few moments to recall the factors involved in the physiology of micturition. Unlike the anal sphincter the internal vesical sphincter cannot be considered a true sphincter in the sense that it consists of a circular band of muscle fibers. In fact, the neck of the bladder, when closed, forms a semicircular slit with its convex portion formed by the confluence of the trigonal muscle as it passes through to its attachment near the verumontanum. Although the internal and external sphincters, the trigonal muscle, and the detrusor vesical or, as it is frequently designated, the true muscle of the bladder, are all actively concerned in the act of micturition, yet the exact correlation between them is not at all clearly understood. Macht maintains that the trigonal muscle has an innervation different from that of the internal sphincter or of the detrusor vesicæ, being by the true sympathetic fibers from the third and fourth lumbar segments by way of the vesical plexus. The detrusor, however, receives its innervation by the parasympathetic fibers through the nervus erigens from the second and third sacral segments. The voluntary elements in the nervous mechanism of micturition pass by the pudic nerve to the urethral muscle. Difficulty in the expulsion of urine may be due to a diminution in the muscular power of the bladder, or to an increase in the tonus of the sphincter muscle or to a combination of both of these factors. The exact nature of the neurological lesion responsible for the disturbance in the mechanism, whether it be a tabetic lesion or a tumor or area of softening in the brain or cord, can be left to the neurologist to determine. An examination of the pupillary reflex, the knee-jerks, the elicitation of abnormal reflexes such as Babinski, will frequently put the examiner on the track of the disturbance. The finding of a spinabifida through a roentgenogram of the lumbosacral spine is not at all uncommon in neurological disorders of the urinary tract.

Paradoxical incontinence manifested by constant dribbling of urine as a result of overflow is the only symptom referable to the urinary apparatus that is characteristic of the neurological bladder. This is, of course, a late symptom. Otherwise the symptoms in this condition are practically identical with those due to fibrosis colli. The cystourethroscopic picture is, however, quite different. In the first place the instrument on passing the cut-off muscle slides into the bladder without the sightest effort. The vise-like muscle grip upon the instrument seen in contracture cases is entirely absent. The typical collar intrusion into the vesical lumen is also absent. However, it is only by a complete and careful routine physical examination that a

correct differential diagnosis can be made between the two types of lesions.

Bladder Neoplasms, and Diverticula obstructing the Vesical Outlet. For a bladder tumor or a diverticulum to obstruct the outlet of the bladder it must be situated close enough to the vesical neck to compromise its lumen. The pedunculated tumor is much more apt to do it than is the tumor with broad base. As for diverticula, they are usually of the dissecting variety, burrowing their way behind the bladder, until they occupy a position between the rectum and the lowermost part of the bladder. A history of painless hematuria followed by symptoms of obstruction to the free flow of urine call for a careful cystoscopic examination. At times it is exceedingly difficult, even with the use of the ordinary cystoscope, to detect a vesical neck tumor especially if situated on the anterior lip of the sphincter. With the Young retrograde cystoscope the difficulty is readily overcome.

In cases of dissecting diverticula the history is usually elicited of fractional emptying of the bladder along with other symptoms suggestive of obstruction. At times it may be possible by rectal examination to detect a soft boggy mass lying above the upper border of the prostate. The cystogram, especially when made with a lateral exposure, clinches the diagnosis.

Retroperitoneal Tumors. These tumors can offer considerable difficulty in diagnosis. Suspicion of their existence is usually aroused upon finding a pelvic mass that persists after emptying the bladder, and a negative bladder cystoscopically. Retroperitoneal tumors as a rule cause more rectal symptoms and venous stasis in the lower extremities than do extravesical lesions. A tentative diagnosis may be ventured through the process of elimination and verified at exploration.

Treatment

The principal aims in the treatment of the obstructive uropathies are twofold, namely, to remove the obstruction and to restore the urinary organs to as near normal as possible. The kidneys are at times so badly damaged that the operative removal of the obstruction becomes not only dangerous but impossible. The subject of therapy is entirely too vast to come within the scope of this paper. It might be profitable, however, to touch upon the broad principles involved in the general treatment of patients suffering from obstructive lesions of the lower urinary tract. The greatest problem in therapy is the rehabilitation of the patient so that he may be made fit for the major operation. This is best accomplished by the process of gradual decompression of the bladder accompanied by active urinary secretion, best induced by encouraging the patient to take large quantities of water by mouth, if possible, or, if vomiting is present, by rectum, hypodermoclysis, or intravenously. Operation is performed only after the surgeon has convinced himself by repeated 'phthalein and blood urea determinations that the renal function has become stabilized. In other words, the treatment directed to the bladder is secondary to that given the kidneys, so that by the time the indwelling catheter or the suprapubic tube has restored the kidney function to optimum the bladder will usually have regained its tone. The actual technique of removing the obstruction is relatively simple, once the patient's condition is improved to a point where he can be made to stand operative intervention.

Conclusion

There is no field in surgery where more gratifying results can be obtained than in urology. And the finest results of all are those obtained on patients with obstructive nephropathies, providing, of course, that they are brought for treatment before permanent impairment of the kidneys has occurred. Finally, it may be stated that the clinician who undertakes to treat one of these unfortunates actually holds the life of that patient in his hands. A good diagnosis and properly instituted therapy, and the patient lives; the reverse, and the patient dies or is condemned to a life of permanent invalidism.

DANGEROUS TENDENCIES IN IODINE THERAPY

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SINCE iodine as a preventive of goiter has been widely advocated by public health authorities and advertised by commercial houses, the physician rarely sees a patient with goiter who has not at some time taken iodine in one form or another. The administration may have been under the supervision of a physician, but more often the patient has treated himself on the advice of a friend or as a result of "educational" advertising. Now that there seems to be an increase in goiter in the Northeast, we are presented with more and more patients who are in a dangerous condition from the injudicious use of the drug.

With every good thing that comes out in medicine we have the concomitant bad feature; charlatans, commercial drug firms, and newspapers making stock of the new discovery and eager to make profit from a real boon to mankind. In the denser portions of the Midwestern goiter belt the quack has had a firmer hold than in the East, but one is led to believe that the laity in that region is now awakening to the dangers of self-treatment. Jackson reports 50 cases of what he chooses to call "iodine hyperthyroidism." As many cases as this in the territory from which he draws his work is proof positive not only of the gullibility of the public but of the uncertain knowledge of the average physician who attempts to treat goiter with iodine. In 28 of his cases iodine toxemia followed treatment by the family physician.

A quack remedy that the patient has taken over a fairly long period of time, however, accounts for most of the dangerous and uncontrollable cases. My idea in presenting this paper is to sound a warning against the spread of this form of quackery in the eastern portion of the so-called goiter belt. Although the charlatan is usually the patent medicine man, he is not the only quack. To place the makers of iodized food stuffs in the same category does not seem too severe, even though they are there unwittingly. Big business clutches at anything that will increase sales. Recently I had occasion to advise against the iodizing of a well-known brand of peanut butter. Already we are putting iodine in water and salt, and unless manufacturers are watched we will be getting doses in all sorts of canned and bottled goods. Thus far, the amount of iodine we receive from other than natural sources is probably so infinitesimal that no harm is done; whether or not it is truly beneficial as a prophylactic will be determined only a good many years hence after careful study of the situation.

At present we should institute propaganda for the control of this potential danger. So far as self-treatment by the laity is concerned I believe that well-directed publicity by health authorities would soon scotch the evil. This is especially possible in the East where health publicity is well organized and the public is accustomed to newspaper articles by health authorities.

Public education in the dangers of iodine therapy is not enough. The treatment of goiter is a much more subtle and delicate matter than most of us have realized, and the physician must give time to a study of diagnosis and methods of treatment. Unfortunately, a certain fearlessness of iodine has developed following Plummer's report on its use in exophthalmic goiter and the general knowledge we have of its use as a prophylactic in Switzerland, Italy, and our own states where goiter is most prevalent. We are bombarded with pamphlets from pharmaceutical houses, and patients of all

ages and with all types of goiter come to the physician demanding to be cured with iodine.

If the patient has an exophthalmic goiter, he has sometimes received a series of treatments with the usual well-known recurrence of symptoms. How difficult this type of case is to deal with every surgeon who does any amount of thyroid surgery well knows. He also knows the brilliant results obtained when Lugol's solution is properly employed preparatory to operation to reduce the basal metabolic rate or control a crisis, and after operation to combat postoperative hyperthyroidism.

Although the continued administration of iodine in exophthalmic goiter is futile and dangerous, it is the adenomatous type of goiter that is peculiarly susceptible to to the misuse of the drug. A certain amount of hyperplasia in toxic adenoma probably accounts for much of the symptom complex of this condition. It is probably because of this hyperplasia that iodine is so often effective in this condition and produces a temporary but deluding benefit.

Although it may appear dogmatic to prohibit the use of iodine in goiters after the age of twenty-one, I am convinced that it is a sound policy for the general practitioner to follow. While there may be possible exceptions to this rule, adherence to it will go a long way toward the control of the misuse of iodine. Patients have an uncanny faculty of finding out what they are taking and broadcasting their little knowledge. If adenomas have not developed before the age of twenty-one, the size of a colloid goiter may be controlled or reduced by the judicious use of iodine. Yet, as Arn has pointed out, this is not always true. Some simple colloid goiters fail to respond to treatment. The simple administration of iodine alone is often not efficacious because the child continues under a nervous or physical strain from overactivity in school work, too much excitement at home, and numerous other causes. This nervous tension throws an extra burden on an already overtaxed gland. The activities of most children with goiter should be restricted so that they will lead quiet lives, as much of the time as possible devoid of undue stimulation.

In many cases adenomas have developed before the age of twenty-one, and in these iodine is very likely to produce toxic symptoms. In these cases a cure with iodine cannot possibly be expected, but if the patient is carefully watched while under treatment it is possible to retard the growth of the adenoma. At the first sign of toxic symptoms the iodine should be stopped, and one should be careful that the gratification of seeing the gland reduced in size does not blind one to the development of toxemia. Hyperthyroidism seldom develops in adenomatous goiters in children except through the misuse of iodine.

For this reason particularly, I believe that the administration of iodine to children of school age should be absolutely under the control of a physician who understands the problem. As prophylaxis means *prevention*, the prescribing of iodine is no longer within the province of the public health physician once a goiter has developed. The administration of iodine is then treatment, and the child should be referred to a competent physician chosen by its parents.

The administration of iodine in prophylactic doses to school children has in many instances been the cause of parents and older members of the family taking some of the drug at home, without supervision. Health officials, therefore, need to go a step further in their work. By that we mean that they should inform the family that what is good for the child may be harmful if taken by adult members.

Summary

1. Immediate steps should be taken by health authorities to warn the public of the dangers of self-administration of iodine.

2. Before using iodine in goiter, physicians should acquaint themselves with the indications as brought out in many contributions by leading authorities.

3. Health agencies should limit themselves to prophylaxis and leave the treatment of existing goiters to the personal supervision of a private physician.

THYROTOXICOSIS AND ASSOCIATED VAGOTONIC AND SYMPATHICOTONIC SYNDROMES*

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INTRODUCTION

SINCE the symptomatology of a toxic thyroid is so closely linked to the sympathetic nervous system it would appear that the line of cleavage between vagotonia and sympathicotonia drawn by Eppinger and Hess would have an intensely practical value.

Lack of uniformity, however, in designation of these two divisions of the autonomic system has added to a confusion already existing based on an anatomical separation difficulty. It is relatively easy to make an anatomical division of these two groups at the center, or even in the vicinity of the cerebrospinal axis, but the intricate peripheral network makes it an all but impossible task at the points where effects on function may be observed.

Langley's pronouncement is, probably, as workable as any other. According to him the autonomic system embraces the entire sympathetic nervous system and is divided into:

(a) The sympathetic autonomic, including certain fibers of the vagus nerve

(b) The vagal autonomic

Under the first grouping are placed all the nerves that pass through the gangliated cord, and in the second, the remaining vegetative fibers or expanded vagus.

The gangliated cord referred to, also called the trunk, passes parallel to, and in front of, the vertebral column and presents a corresponding ganglion for each vertebral segment.

The autonomic system is also called the vegetative nervous system and may be visualized as an outgrowth of the cerebrospinal system.

This nomenclature would seem simple and sufficient, but the perplexity lies in a manifest lack of agreement in designating the same thing by the same name. For example, Pottenger uses the terms "vegetative" and "autonomic" synonomously, but speaks of the two divisions as "sympathetic and parasympathetic." Other authors call the extended vagal division the autonomic system and yet others refer to it as the vagus system, thus making confusion worse confounded. Some other authors classify the sympathetic autonomic division as the thoracico-lumbar and the vagal autonomic division as the craniosacral division. Still others would classify the vegetative system according to the function of the nerve fibers; hence, vaso-viscero-glandulomotor accelerator division and the vaso-viscero-glandulo-motor inhibitory fibers. This designation fails to clarify the situation since nerves from both the sympathetic autonomous and the vagal autonomous divisions possess positive and negative effects on muscles.

The nomenclature of this part of the nervous system is as unsettled as that pertaining to the thyroid, the classification of which is yet in a bewildering state of flux.

The vegetative system may be divided anatomically into two units. One is composed of fibers originating in the middle portion of the thoracic and the upper lumbar cord which pass through the gangliated cord after which many become mixed with other fibers and their identification where they terminate as end organs becomes difficult or impossible. The fibers of the other unit have their origin in the

* Read by title at the Annual Meeting of the American Association for the Study of Goiter, Philadelphia, February 1, 1927.

brain, the medulla and the sacral segment of the cord and do not have a relation to the ganglionated cord.

In contrast with this Babel of terms of anatomical structures the physiological facts are more uniformly agreed upon. All agree that the vegetative organs have a dual nerve supply which is antagonistic. It is further agreed that this double innervation of these organs not under the control of the will is of tremendous importance. This mutually antagonistic arrangement maintains a balance in function which is indispensably protective. The inhibitory influences are, indeed, anything but superfluous when one considers the normal state of irritability of the ganglionic cells. This irritability could be geared to normal needs and normal stimuli but the lack of a check when subjected to abnormal stimuli as in functional or organic changes would lead to results highly dangerous, even fatal. The effect of a febrile process on the heart rate were there no antagonistic agency is an example of easy understanding.

If the physiological process were as simple as appears on casual study, doctors would have more time for music or golf. But the influence of endocrines seems ubiquitous. The secretions of these glands exert a powerful effect on the mechanism of body metabolism and the extent to which this effect is accomplished through their action on the vegetative nervous system, is at once an interesting and largely unsolved problem. The action, so far as known, of the endocrine secretions on metabolism would seem to justify grouping them into those (a) activating, and those (b) inhibiting it. In the first group may be placed the thyroid, suprarenal and pituitary glands while in the second group would be found the thymus, pancreas and parathyroid glands. This relationship to metabolism covers proteins, fats, carbohydrates and mineral substances. The hypoglycemia of hypothyroidism, dyspituitarism and Addison's disease is common knowledge. The relationship between calcium deficiency and parathyroid loss is also well established, while that between endocrine dysfunction and muscular dystrophies exists but is less well known.

Whenever the balance between the sympathetic and vagal autonomic divisions which exists normally is disturbed one or the other obtains the ascendency. If it be the vagal, then the group of conditions consequential thereto is termed vagatonia; if it is the sympathetic it is termed sympathicotonia. Between these two groups, numerous mixed, even transition forms may be encountered which muddy the clinical waters. Certain of the endocrine hormones act through the vagal division alone while others act through the sympathetic and yet others act thorugh both. The adrenals are active, powerful sympathicotonic agents while the pancreas exercises an equally selective effect on the vagal division. Thyroid secretion expresses itself through both, hence, the hypothyroid patient is not purely vagatonic nor is the hyperthyroid victim purely sympathicotonic.

VAGATONIA

Viewed clinically, vagatonia appears to be a chonic state of vagal excitability and the organs supplied by this system will be found to be in a state of irritability. Recalling the structures receiving their nerve supply through the vagal system, the symptoms of vagatonia become a matter of multiplied physiological action. Through it the gastric and pancreatic secretions are increased, peristalsis reinforced, the heart slowed, Zinn's zone relaxed and the pupil contracted.

One might hesitate to accept the announcement of Eppinger and Hess that a patient having a vagatonic syndrome has, therefore, constitutional inferiority, but that it may occur in individuals with an inferior constitutional make-up is admitted; that an unstable nervous equilibrium constitutes a background for hyperacidity with pylorospasm is believed and that this latter condition is often an ante-

cedent clinical phase to peptic ulcer, the writer has come to chronicle in his records. In other words, many cases can be definitely grouped as vagatonias and many as sympathicotonias and the recognition of mixed and transitional groups need in no wise lessen the value of such clinical grouping. The group having a vagatonic bias represents the young adult period and middle age and often loses it entirely as old age is encompassed. In its relation to thyroid secretion one cannot escape the perplexing knowledge that this gland is more active during the reproductive period of life with a tendency to hypothyroidism with the age of the "lean and slippered pantaloon." It can partly be explained by the assumption that thyroid hormone affects both the vagal and sympathetic autonomic systems.

The following grouping of the symptoms of vagatonia is not original except as to the order of arrangement.

(*a*) Eye
- Narrow palpebral fissure
- Blepharospasm
- Infrequent winking
- Enophthalmos
- Epiphora
- Accommodation spasm
- Myosis

(*b*) Skin
- Hyperhydrosis
- Acrocyanosis
- Dermatographia
- Acne
- Hyperresponsiveness to pilocarpine

(*c*) Respiratory System
- Irregular respiration
- Bronchial asthma
- Laryngospasm
- Husky voice

(*d*) Circulatory System
- Arrhythmia
- Bradycardia
- Eosinophilia
- Pseudoanginal attacks
- Erythromelalgia

(*e*) Digestive System
- Diminished gag reflex
- Increased salivary flow
- Esophagismus
- Cardiospasm
- Hyperchlorhydria
- Pylorospasm
- Gastric hypertonia
- Reflex vomiting
- Mucous colitis
- Tender colon
- Spasm of sigmoid
- Constipation
- Visceroptosis
- Visceral crises
- Aerophagia

(*f*) Nervous System
- Insomnia
- Mental irritability
- Sexual hyperexcitability
- Nervous chills
- Easy fatigue
- Lack of confidence

(*g*) Metabolism
- Increased sugar tolerance
- Increased fat tolerance
- Status thymolymphaticus

SYMPATHICOTONIA

Sympathicotonia is practically a normal condition in females and though occurring in a fairly large percentage of males it should be looked upon in men as a stigma of feminism. Its anatomical as well as physiological anomalies occur chiefly in the nervous cardiovascular system. Neuropaths and psychopaths are common in this group, likewise neurasthenia finds plentiful recruits in these unstable nervous individuals.

In grouping the phenomena of sympathicotonia it is of advantage to arrange them after the scheme followed in setting down those of the vagatonic group.

(*a*) Eye
- Mydriasis
- Myosis on forced inspiration
- Myosis on forced expiration
- Wide palpebral fissure
- Diminished lachrymal secretion
- Winking reflex diminished
- Prominence of eyeball
- Faulty convergence
- Loewe test negative

(*b*) Skin
- Urticaria
- Angioneurotic edema
- Facial pallor on emotion
- Hypohydrosis
- Cutis anserina
- Pigmentary anomalies
- Canities, unilateral or bilateral
- Psychic flushing
- Salivation not increased by pilocarpine

(*c*) Respiratory System
- Dyspnea
- Tachypnea

(*d*) Circulatory System
- Precordial distress
- Palpitation

Exaggerated amplitude of cardiac contractions
Apical impurity after fatiguing exercise
Pulsation of superficial vessels
Capillary pulsation
Tachycardia, orthostatic
Vasomotor lability
Respiratory arrhythmia
Aschner's phenomenon
Goetsch's test

(e) Digestive System
Intestinal colic
Nervous diarrhea
Hypochlorhydria
Gastric atony
Lessened secretions of gastrointestinal tract
Diminished salivary secretion
Lessened peristalsis of intestine
Hypertonicity of intestinal sphincter
Painless dysphagia
Gag reflex, increased

(f) Nervous System
Neuroses
Psychoses
Emotional polyuria
Pollakiuria
Exaggerated emotivity

(g) Metabolism
Low sugar tolerance
Alimentary glycosuria

CLINICAL APPLICATION

While the manifestations attributable to either the vagatonic or sympathicotonic group may be kept in mind during the clinical study of a case and set down in a record of physical findings, yet they will be disconnected. The writer has found it convenient to keep them grouped in order to make a visual inventory helpful to an intelligent summary at the close of the study. A sheet tabulating the more important features of the two conditions is made a part of the record as is the laboratory sheet or a graphic temperature sheet; on this is noted the result opposite each phenomenon. Thus at a glance the clinical picture may be reviewed at any subsequent study of the case. The words *present* or *absent*, *positive* or *negative*, or the signs *plus* or *minus* may be selected for noting the findings as the clinician may desire. The writer uses the signs plus and minus as the degree of the existing phenomenon may be indicated by +, ++, +++ and so on similar to recording a Wassermann reaction.

Chart No. 1 is taken at random from the records of cases so studied and shows a preponderance of vagatonic symptoms. The fact that some were negative makes the conclusions no less definite.

CHART NO. 1

HYPERPLASIA OF THYROID WITH TOXIC SYMPTOMS. BASAL RATE WAS PLUS 19 PER CENT, MALE, WHITE, AGED TWENTY-NINE YEARS

Vagatonia

Phenomena	Reaction
Myosis	+
Narrow palpebral fissure	−
Hyperhydrosis	+
Achrocyanosis	+
Dermatographia	+
Acne	+
Pilocarpine hyperresponsiveness	+
Bradycardia	−
Erythromelalgia	−
Gag reflex diminished	+
Cardiospasm	−
Pylorospasm	+
Hyperchlorhydria	+
Reflex vomiting	−
Mucous colitis	−
Spastic sigmoid	+
Visceroptosis	−
Aerophagia	+
Mental irritability	+
Increased sugar tolerance	−

Chart No. 2 shows a preponderance of sympathicotonic symptoms.

CHART NO. 2

COLLOID GOITER WITH ADENOMATA, TOXIC. BASAL RATE WAS PLUS 62 PER CENT, FEMALE, WHITE, AGED TWENTY-EIGHT YEARS

Sympathicotonia

Phenomena	Reaction
Mydriasis	++
Winking reflex infrequent	+
Wide palpebral fissure	+
Conjunctiva dryness	+
Convergence faulty	−
Loewe test	+
Urticaria	−
Hypohydrosis	+
Cutis anserina	−
Psychic flushing	+
Tachypnea	−
Palpitation	+++
Heart hurry	++
Aschner phenomenon	+
Goetsch test	+
Hypochlorhydria	+
Salivary response to pilocarpine	−
Gag reflex increased	+
Psychoses	−
Low sugar tolerance	+
Glycosuria	−

These two charts are sufficient to indicate the truth of what has already been

said that when the equilibrium of the two autonomic divisions is disturbed one or the other usually obtains ascendency. The difficulty lies in an inability to predetermine which will prove the dominant phenomena in a given patient when the thyroid toxicity does develop. In other words, in the writer's experience both groups of phenomena occur in thyrotoxicosis, but it should also be stated the sympathicotonic has been found in the larger per cent of his group of cases. This has been true only so far as predominance of phenomena is concerned, however, as such symptoms as dermatographia, gastric retention, hyperchlorhydria, pylorospasm and a spastic sigmoid have occurred in a majority of the cases. On the other hand, mydriasis, wide palpebral fissure, psychic flushing, palpitation, tachycardia, positive Goetsch's test and vasomotor lability have occurred in the larger per cent of the group. This overlapping of the two groups introduces the mixed or transition group which deprives the attempt at classification of an entirely satisfactory value in a study of goiter cases.

The influence of a toxic thyroid in lowering the threshold of excitability of various organs resulting in the physiologic anarchy characteristic of hyperthyroidism may be admitted without denying the clinical value of observance of these two fundamental types.

May we then be justified in accepting the classification of vagatonic and sympathicotonic syndromes as clinical realities since it has induced a more searching study of vagosympathetic functions? Is it an error to conclude that the conception of Eppinger and Hess has provoked a systematization of an hitherto chaotic symptomatology of functional nervous disorders? Admitting there exists a close relationship between the sympathetic nervous system and thyrotoxicosis, does it not appear there may also be a vagatonic form of toxic goiter? And finally, was Roger far wrong when he thought that "The conception of vagatonia and sympathicotonia gives a scientific form to old conceptions," and that the individuals manifesting these syndromes "are subjects whose organic nervous systems suffer the rebound of disorders caused in the internal secretions?"

SUMMARY

Lack of uniformity in the nomenclature of the anatomical divisions of the vegetative nervous system is demonstrated.

The physiologic grouping of this system is more uniformly agreed on.

Vagal and sympathetic imbalance may be induced by the internal secretions.

The basis for the classification of vagal and sympathetic syndromes is discussed and a grouping of clinical evidences of vagatonia and sympathicotonia for diagnostic use is offered.

Charts showing vagal and sympathetic predominance in thyrotoxicosis are given.

The value of accepting vagatonic and sympathicotonic syndromes as clinical entities is considered.

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[SURGICAL SUGGESTIONS]

THE free transverse abdominal incision gives a good exposure and is easily sutured; but if a hernia occurs it is apt to assume monstrous proportions; it is hard to retain and may be very hard to cure.

THE portion of the common bile duct in the wall of, and behind, the duodenum is much longer than it is generally thought to be; and one must be wary of the evidence of patency afforded by passing a sound or probe. The instrument may be thought to be in the duodenum when, in fact, it is merely pushing the duct papilla into the bowel.

THE OPERATIVE TREATMENT OF RETROVERSION OF THE UTERUS*

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THE tremendous development of surgical therapy made possible by anesthesia and asepsis has naturally enough been accompanied by an enthusiasm for one or another operation, which later experience modifies. A constant questioning and review of operative results is therefore necessary.

I have ventured to offer here a follow-up study of results in a controversial field of surgical therapy, retroposition of the uterus, hoping that it may be of interest both to the medical man who must advise in this common condition and to the surgeon who may be called on to operate.

That there is a difference of opinion as to the significance and indications for operative treatment of retroposition is apparent from a study of recent literature on the subject.

Bevan[1] of Chicago in a recent editorial stated, "Time and scientific investigations have proved beyond question that retroposition of the uterus produces no local or general symptoms of any kind, that when symptoms are present with this condition they are due to complications. These facts are now so clearly established that we must conclude without any reserve that the time has arrived when operations done on women for retroposition of the uterus, for this condition alone, are unwarranted, unnecessary and indefensible."

On the other hand, Ward[2] maintains strongly that mobile retroverted uteri may lead to symptoms and quotes Crossen, Polak and Graves in support of his position. He states that when the displacement is undoubtedly chronic and the cause of distress an operation is indicated for its correction. His experience at the Woman's Hospital, New York, bears out this view.

The present study is based on cases of retroversion of the uterus operated on at St. Luke's Hospital in the past eight years, the object being to examine the indications for surgical treatment. Only those cases have been included in the series in which a suspension was the sole gynecological procedure with the exception of a few in which a curettage was also done. The large majority had appendectomies and an occasional one some additional non-gynecological procedure. This reduces the number of available cases very greatly from the list filed under the heading of retroversion. It is clear, however, that if patients on whom such procedures as perineorrhaphy, trachelorrhaphy, salpingectomy or myomectomy have been done in addition are included the value of the suspension itself will be in doubt. Patients who have not been followed at least six months have been eliminated in order to give time for any psychic effect to wane. The average period of observation after operation is over a year. With one or two exceptions who have reported by letter, the patients have been examined at the hospital. The series consists of 74 cases operated upon by 12 different surgeons.

SYMPTOMS

That retroversion of the uterus may be found in women enjoying good health is a common experience. Lynch[3] in a study of retrodisplacements following childbirth found that only 42 per cent presented symptoms; of these 11.5 per cent came to operation.

In this study the chief symptoms complained of were backache, pain in the lower abdomen, sometimes located in one side or the other, pain at or made worse by

* From the Surgical Services, St. Luke's Hospital. Read before The Hospital Graduates' Club, New York City, February 24, 1927.

menstruation, discharge, menstrual irregularity and bearing-down sensations, named in the order of frequency. An examination of the complaints in those whose result was considered satisfactory as opposed to those whose result was poor does not show outstanding differences. Pain associated with menstruation was, however, relatively more frequent in the successful cases.

Many patients date their symptoms to an abortion or confinement and this is a matter of much significance.

None of the symptoms are characteristic of retroversion as distinguishing it from other gynecological conditions. On the other hand, the fact that a considerable proportion of women presenting one or more such complaints with retroversion were improved following suspension, makes it logical to believe that the displacement can lead to symptoms.

DIAGNOSIS

Since the symptoms cannot be considered characteristic, it is essential that other causes for them be carefully ruled out before attributing them to retroposition, unless the uterus is definitely tender and adherent.

The neurotic or physically inferior patient often presents herself with a retroversion and symptoms mainly gynecological but ordinarily sufficiently widespread to arouse the suspicion that the correction of a pelvic disorder will not effect a cure. Such cases are likely to be failures at the follow-up examination and do much to discredit the operation.

Backache is a common ailment in women and an orthopedic basis for it should be ruled out before associating it with displaced uterus. The backache associated with disorders of the pelvic organs is lower lumbar or sacral (Graves[4]).

In a few failures a study of the case points to a urinary disorder as the real trouble. Pain from this source should not be forgotten. Frequency of urination is mentioned in a number of the histories but to my mind it is of very doubtful significance as far as retroversion is concerned.

Leucorrhea is another complaint rather frequently listed. My impression from this study is that suspension of the uterus cannot be expected to relieve this condition.

There are several cases in which the chief complaint was recurrent attacks of pain in the right lower abdomen and in which the operative findings made it evident that the real diagnosis was appendicitis. Such a mistake is not serious as the appendix should always be inspected and is ordinarily removed when the lower abdomen is opened.

Colitis may be the cause of abdominal pains which in the presence of a retroversion might be attributed to it.

Stacy[5] has clearly shown that in unmarried women in whom infection, pregnancy and tumor could be ruled out, dysmenorrhea occurred in but little higher percentage in those with retroposition than when the uterus is anterior. It is therefore clear that unmarried patients complaining of dysmenorrhea as the chief symptom, should be selected for operation with especial care. This series includes examples of such cases with satisfactory outcome, however.

The operations done on these patients were mainly the Gilliam or other type of round ligament suspension. There were a number of operations by the Coffey technique and an occasional Baldy-Webster and ventral suspension. The anatomical results show a very small number of failures. One is listed as such, and two others are reported, respectively, as retrocessed and drawn to one side. From an anatomical standpoint the operation can be considered satisfactory and the test of its value depends on the symptomatic benefit received.

END-RESULTS

In going over these cases I have attempted to be conservative in estimating the outcome. There is, however, a lack of definiteness about many of them and their reports, which makes estimation of benefit difficult.

The end-results have been listed under three headings: satisfactory, improved and poor. Of these the proportions are: satisfactory 59 per cent, improved 18 per cent, poor 23 per cent.

Other recent figures follow: Ward[2] from the Woman's Hospital, New York, reports 561 cases with 88 per cent relieved of their clinical symptoms. Pool and Hawks[6] from the New York Hospital report for 1915–1920, 78 cases with 56 per cent symptomatically good and in the next five-year period, when the operative indications were more carefully drawn, 51 cases with 70 per cent symptomatically good. Hurd[7] in a paper recently presented before the New York Obstetrical Society analyzed 1000 operative cases from the Woman's Hospital. Of these 149 were uncomplicated, giving subjectively 80 per cent successes, 15 per cent partial successes and 5 per cent failures.

That an adherent retroversion furnishes a clearer indication for operative treatment than a non-adherent uterus is generally conceded. If the group of adherent retroversions, 17 in number, in this series is considered, the figures are somewhat better than for the whole series, namely, satisfactory 65 per cent, improved 24 per cent, poor 12 per cent.

One woman who had a miscarriage some years previously submitted to operation because of her desire for children. During the two-year period of observation she had not become pregnant. On the other hand, in several instances a pregnancy followed within a few months of the operation, one of them in a woman married one and one-half years without a previous pregnancy.

Hurd[7] in his paper reports about one pregnancy in every four cases operated on where sterility was a complaint. This included both complicated and uncomplicated retroversions.

One patient desirous of children was operated on for adherent retroversion because of two miscarriages. When last examined she was well advanced in pregnancy.

A number of writers give as an indication for operation relief by trial support of the uterus with a pessary. This is obviously applicable only to patients whose retroposition can be corrected bimanually. It would seem logical, however. Unfortunately, data as to this point are lacking in this series. One patient is mentioned as having worn a pessary without relief. Her operative result was poor.

As a result of this review, I feel that too many cases have been operated on and I shall be more conservative in advising suspension in retroposition. Perhaps I am influenced in this opinion because I have contributed more than my share to the symptomatic failures. On the other hand, there is sufficient evidence that operation has a place in the treatment of retroposition and should not be discarded.

It would seem that some of the disagreement concerning the question of operation hinges about the interpretation of the terms "complicated" and "uncomplicated." In this study uncomplicated retroposition has been used to indicate retroposition, adherent or nonadherent, unaccompanied by some other conditions of the genital organs requiring operative correction. However, it is a common belief that it is not the retroposition itself but rather allied subinvolution, congestion, interference with broad-ligament blood supply or adhesion formation that causes the symptoms. In this sense all symptom-producing retroversions are probably complicated. A young woman applied for treatment, complaining bitterly of lower abdominal and rectal pain and dyspareunia following a febrile confinement some months before. She had an immobile, tender, retroverted uterus. She was cured of her symptoms by suspension of the uterus. Probably few surgeons would deny that she had presented an operative indication. On the other hand, a young woman in the course of examination was found to have a retroverted movable uterus. She stated that following the birth of her child she had been treated for a year by her doctor for

retroversion but had finally gone to an osteopath who had cured her of her symptoms. The most ardent advocate of suspension would have hesitated in this instance to recommend an operation. The former case was complicated in that she had a congested, adherent uterus, uncomplicated in that there was no adnexal or other genital disease. The second case was uncomplicated from every viewpoint.

CONCLUSIONS

The indications for operation in retroposition uncomplicated by other gynecological conditions should be very carefully drawn. The neurasthenic or physically subnormal patient with an assortment of pains is an especial source of disappointment in the follow-up clinic.

Back strain, myositis and vertebral disease as causes of backache, visceroptosis and urinary infections as causes of abdominal pain should be remembered and ruled out.

Abortion and childbirth are a common starting point of symptom-producing retropositions.

Operation is most clearly indicated for adherent, tender uteri.

Repeated abortion in women with immobile retroversion is an indication for suspension.

Not too much can be hoped for from suspension in sterility although there is some evidence that it may be a factor.

The anatomical results are good.

In properly selected cases satisfactory results can be obtained.

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THE MEANING OF BACKACHE IN GYNECOLOGY

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BACKACHE is said to be one of the most frequent of all gynecologic complaints. Lynch,[1] analyzing a series of 1041 gynecologic cases, found that 49 per cent of the patients had lumbosacral pain and that in 76.5 per cent of instances this disturbance was due to a gynecologic condition. Graves,[2] in an analysis of 500 cases of retroversion, found backache a definite symptom in 76 per cent. According to Ward,[3] 85 per cent of cases of lumbosacral bachache are of gynecologic origin and only 15 per cent are due to orthopedic causes. In my own experience, the above figures with regard to the etiologic importance of gynecologic conditions are unduly high and other factors, including sacroiliac abnormalities, urologic disturbances and toxic conditions, are entitled to equal attention; nevertheless the fact remains that bachache is an important symptom in gynecologic cases.

Gynecologic diseases, particularly retrodisplacement of the uterus, were long held to be almost the sole cause of backache in women. More recently, however, careful observations have proved that orthopedic factors in the nature of deviations of the vertebral column and pelvis from the normal constitute a fairly prolific cause of sacral pain. A further factor is an increased sensibility of the vegetative nervous system, which is commonly associated with states of lowered vitality.

A woman's backache is usually located in the sacral region. In the absence of a gynecologic condition, it may be due to disease of the other pelvic viscera, abdominal disturbances, or irregularities of the bones, joints or muscles of the lower part of the back, the lower abdomen or the thighs. A faulty posture, fatigue from overwork or unhygienic habits, and focal infection are further important etiologic factors.

TYPES OF BACKACHE

Backache in women may be classified conveniently under three headings: 1 the pelvic type, 2 the orthopedic type and 3 backache due to focal infection.

1. *The Pelvic Type* may be subdivided into two varieties, namely, (a) backache due to physiologic congestion and (b) that due to uterine displacements. The first variety is apt to occur during the childbearing age, especially at the time of the menstrual period. It arises from the periodic engorgement of the pelvic organs associated with this function. A temporary aggravation of habitual constipation may also be responsible for this form of backache. The second variety arises from the circulatory disturbances associated with uterine malpositions and the consequent dragging on the uterine ligaments and supports. While constantly present, it is aggravated by menstruation and may be accompanied by vesical and rectal symptoms.

2. *The Orthopedic Type.* Sacroiliac abnormalities constitute the most important causes of this type of backache. However, attention must be given to faulty postures, especially exaggerated lordosis; to fallen plantar arches associated with spinal rigidity; and to inflammatory conditions affecting the lumbar muscles or fascia. Syphilitic spondylitis may give rise to severe lumbar pain. Sacralization of the fifth lumbar vertebra, that is, an exaggerated development of its transverse process so that it resembles a part of the sacrum, is another occasional cause of persistent back pains. According to Doub,[4] calcification of the

iliolumbar ligaments may cause backache in a certain number of cases. Urologic conditions must be investigated in cases of obscure backache, as many disturbances affecting the excretory apparatus are capable of giving rise to severe backache. Lumbar backache is a common result of fatigue or faulty posture; sacral discomfort, on the other hand, is usually independent of muscular or articular strain and arises most often from gynecologic affections.

3. *Backache Due to Focal Infection.* In a small group of women, backache undoubtedly arises from focal infection. The cause of the pain in such cases is a toxic arthritis affecting the spine or sacroiliac articulation, which arises from such distant foci as the apices of the teeth, the crypts of the tonsils or the accessory nasal sinuses. Following a recent influenza epidemic, many women who had suffered from the disease in either a mild or a severe form complained of backache for months afterward. In the majority of instances, the pain was around the scapula; but in several cases I observed it in the sacral region at a site that has usually been regarded as typical of gynecologic diseases. This backache was of the rheumatic type and subsided gradually as the defensive forces of the body overcame the local infection.

DISCUSSION OF CAUSES

Returning to the gynecologic causes of backache, it must be admitted that pelvic congestion and inflammation with traction on the uterine ligaments are a common cause of lumbosacral pain. Conditions apt to produce backache include retroversion of the uterus, prolapsus, rectocele and cystocele. A fibromyoma, by exerting pressure on the roots of the sacral nerves, may cause backache. The nerve trunks in the hollow of the sacrum are easily affected by pressure from any cause, including congestion, a displaced uterus, traction on the ligaments or a tumor. When the cause of this pressure is removed, the backache is relieved. Treatment may take the form of manual replacement of the uterus and the use of a pessary, correction of faulty posture, local measures for the relief of congestion or surgical intervention.

Affections of the bony ring of the pelvis constitute an important cause of sacral pain in women. Accurate roentgenographic study of the vertebral column and pelvis will disclose the origin of many backaches that were formerly assumed to be of gynecologic origin. Typical cases result from injuries of the pelvic girdle by repeated pregnancies, a condition somewhat analogous to partial separation of the symphysis pubis following childbirth. On examination in such cases, a deep-seated lumbar lordosis is noted and the roentgen plates show a more or less symmetrical lowering of the sacrum between the ossa innominata with pronounced rotation of the sacrum around a transverse axis, widening of the sacral symphyses and relaxation of their attachments. The application of a strong pelvic supporting belt around the ring of the pelvis gives considerable relief.

Many cases of backache arise from orthopedic conditions affecting the pelvic bones, especially those that are associated with abnormal mobility and relaxation of the sacrum. Sometimes associated arthritic changes are demonstrable. From a clinical viewpoint, these cases are fundamentally different from those associated with sacral pains occurring around or after the climacteric; in the latter group, the condition is primarily an arthritic process of the vertebral or sacroiliac articulations. In either case, however, the increased body weight superimposed upon the joints by the advent of pregnancy or the menopause necessarily increases the severity of the backache.

Tuberculosis of the sacroiliac articulation or arthritis of the sacrococcygeal joint may cause sacral pain, which may be associated with uterine displacement and thus give rise to confusion. Localized sacral pain on crossing the legs is especially characteristic of chronic arthritic disturbances, as is also pain in the hollow of the sacrum on vaginal pressure against the synchondrosis or the rami of the ischium.

TREATMENT

Considering the diverse conditions that may cause backache in women, no single method of treatment can be followed. Treatment must necessarily be guided by the particular cause of the backache in a given case. Responsible gynecologic conditions must be corrected, whether by reposition of a displaced uterus, local treatment for congestion or operation. Adequate exercise, especially walking in the open air with proper footwear, helps to relieve pelvic congestion. A fair number of cases of backache are due to flat feet, and in such cases correct treatment for the arches causes the backache to disappear. In cases due to orthopedic disturbances of the pelvic ring, the application of a strong supporting belt gives much relief. Symptomatic backache arising from focal infection demands the localization and removal of the offending foci as far as possible.

From what has been said it is apparent that the so-called gynecologic backache is gradually losing ground with the advent of more exact knowledge; that various abnormal conditions not associated with the pelvic viscera may cause lumbosacral pain in a definite percentage of cases; and that, in every individual case, the cause can be found only after a careful examination of the whole patient.

SUMMARY

Gynecologic affections have been variously estimated to be the cause of lumbosacral backache in women in from 30 to 85 per cent of cases. Recently, however, more exact knowledge has greatly reduced the relative importance of the so-called gynecologic backache. In my own experience, the gynecologic causes of backache have been greatly overestimated.

There are three great groups of backaches occurring in women; namely, 1 the pelvic type, which may result from a physiologic congestion at the menstrual epoch or uterine malpositions and pelvic inflammation; 2 the orthopedic type, arising from such conditions as sacroiliac relaxation, faulty posture, flat feet, spondylitis, and involvement of the lumbar muscles or fascia; and 3 the focal infective type, due to distant infection in the teeth, tonsils, accessory nasal sinuses, or elsewhere.

Every case of obscure backache requires a study of the entire patient. Only when the investigation is conducted carefully from all angles may we hope to discover the particular cause in an individual case and thus be in a position to direct effective treatment.

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ILEOCECAL AND JEJUNOCECAL INTUSSUSCEPTION IN AN INFANT

A CASE REPORT

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NEWARK, N. J.

ON July 6, 1927, I was summoned to see a case in consultation with Dr. Julius Levy, a pediatrist of this city. The patient was a child of Italian birth, two years of age, whose history other than that of the present illness, was negative.

For three months the child had had cramps in the hypogastric region extending upward and downward and coming on at irregular intervals, chiefly during active play, at which time he would place his hand on his side and come crying to the mother, would go to bed, sleep for a short time, and then resume play. The mother finally brought the child to Dr. Levy and upon the second visit she announced that with the last attack the child passed a slight amount of blood. Dr. Levy found a mass in the splenic region, its direction in the line of the transverse colon. It felt doughy and, at the time, the upper abdomen was rounded from the size of the tumor. There was a tympanitic note below the mass and in the right, upper aspect of the epigastrium. He made a diagnosis of intussususception, in which I concurred. A roentgenogram showed an obstruction at the splenic flexure.

At operation that evening the mass was found in the left upper abdominal region, and proved to be the cecum in which were invaginated the cecum upon itself, a knuckle of the ileum, and one of the jejunum. The jejunum was carefully extricated, then the ileum with its ileocecal portion, the appendix and the invaginated portion of the cecum. The appendix was inflamed, covered by dense adhesions, flattened upon the surface of the cecum, and was 7 inches long. The appendix was removed, the raw surface was peritonealized, and the cecum was rotated back to its normal site and fastened to the pelvic peritoneum by two small gut sutures. It was noted at the time that the cecum was thickened to the extent of one-fourth of an inch. The child made a perfect recovery.

I have been unable to find a case of this kind in the literature.

SURGICAL CLINIC FROM THE

HENRY FORD HOSPITAL, DETROIT

MORBUS COXAE SENILIS*

D. C. DURMAN, M.D.

DETROIT

THREE cases will illustrate a condition seen rather frequently in the orthopedic clinic, but not usually appreciated in the course of a general examination.

The first patient was a man aged sixty-five years, seen here in 1925. He complained of severe pain in the right hip and gave a history of having been slightly injured some time before, with development of a good deal of disability in this hip, being unable to do his work. He was fairly well preserved physically, and weighed 173 pounds and had a blood pressure of 176/96. Very little was found to be abnormal in the course of the general examination. He walked with a marked limp. There was actual shortening of 1¼ inches on the right side. There was 25 degrees of fixed flexion deformity and about an equal amount of adduction deformity. Roentgenograms (Fig. 1) showed marked increase in the size of the head of the femur; the head of the bone was irregular in outline and much increased in density. The irregularity was more marked in the lower portion. As the down growth of bone increases in these cases, the femur is pushed upward and out of the acetabulum. This fact, together with some actual decrease in the angle of the neck and shaft of the femur, account for the shortening and adduction deformity.

The second patient was a man sixty-two years of age, who had been more or less active all his life. There was no history of previous illness. For many years he had been a stage acrobat. He stated that four years ago he began to have pain in his hip, usually worse at night; this kept him from sleeping. However, the deformity was not very marked. He had a good deal of trouble in getting around at work. During the last few years he had been in the furniture repair business and had not had to do much walking, but walking very short distances tired him extremely and produced rather severe pain in the right thigh. He, too, was found to be fairly well preserved; weight 138 pounds; blood pressure 140/95. The rest of the examination was practically negative. He had about 70 per cent normal flexion in the hip, the limitation being most marked in abduction and rotation. There was also a hyper-lordosis of the lumbar spine and a good deal of rigidity of the spine on manipulation.

The third patient is a man aged seventy-two years, who has always been well until his present illness. He came in about a month ago complaining of severe pain and disability in the right hip. For the past two years he has not been able to work at his occupation as a farmer because of disability. The physical findings in his case are practically identical with those described in the two previous cases. He has shortening, flexion deformity, adduction of the right hip, with pain on manipulation and considerable limitation of motion in all directions. The roentgen-ray findings are also typical (Fig. 2). The head of the femur is enlarged, with much spur formation and thinning of the joint cartilages. The head is flattened. It is apparent from study of the roentgenograms alone that normal joint motion is impossible.

The gross pathology in these cases is similar to that of hypertrophic arthritis. There is fibrillation and thinning of joint cartilage, often complete disappearance of cartilage in the areas of greatest pressure not by erosion but by devitalization and attrition with the exposed underlying cortex hard and smooth as a billiard ball. The bone is of increased density at the cortex but the latter is thin, and directly beneath it the bone may be atorphic, with cyst-like areas of absorption. Joint fluid is usually subnormal in amount, the synovial membrane is infiltrated and the fibrous capsule is tough and decreased in elasticity. The essential distinction from typical hypertrophic arthritis is in

*From the Orthopedic Department of the Henry Ford Hospital.

the relatively slightly amount of marginal lipping or spur formation and the marked total enlargement of the femoral head as well as articular surface, combined with coxa vara. In general, in this disorder, the other joints show osteoarthritic changes consistent with the age of the patient, this being practically always true with the opposite hip.

The condition represented by these three patients is known as "morbus coxae senilis" and seems to be a distinct clinical entity, and as such, deserves further consideration as to etiology. In his masterful Hugh Owen Thomas

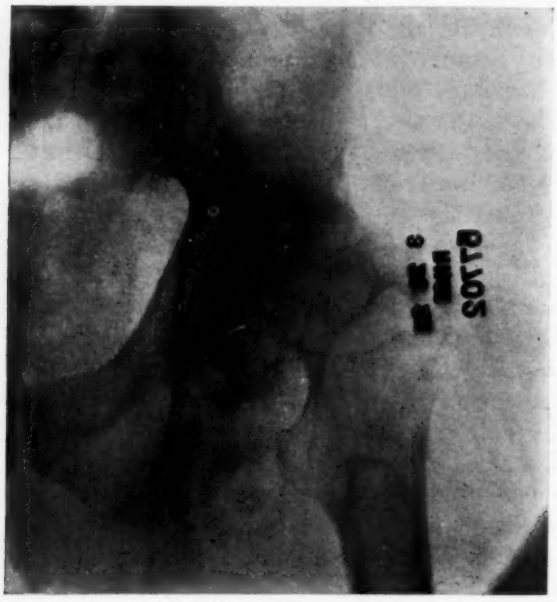

Fig. 1. Case 1. Right hip showing mushroom appearance of the head of the femur.

lecture[1] before the Medical Institution of Liverpool in June 1925, Osgood classed this affection as a form of osteoarthritis, and I believe that most authorities also classify it as such. It nearly always occurs after the age of fifty, and there are other evidences, in patients having this disease, of a hypertrophic arthritis. The peculiar localization of the condition to one hip is a factor which has not been explained. Certain aspects of this condition lead us to believe that it may be the end-result of a long-standing process. In 1910 Legg of Boston first described a peculiar affection of the hip joint, which has been given the name of "osteochondritis deformans juvenilis," or as he is pleased to call it, "coxa plana." In a recent paper[2] he presented the end-results of a series of his own cases. In studying the two conditions morbus coxae senilis and coxa plana, simultaneously, it occurs to me that the former condition might be the end-result of the latter, although in the patients we have seen in this Clinic, there is no history of any trouble with the hip early in life. It is difficult to say what the findings in the cases which Legg reported will be when they reach the age of fifty or sixty. In the discussion of Legg's paper, several cases were reported in brief in which the original diagnosis was coxa plana, but in which a question of tuberculosis existed. An exploratory operation was made for the purpose of diagnosis, and some minute cyst-like cavities were

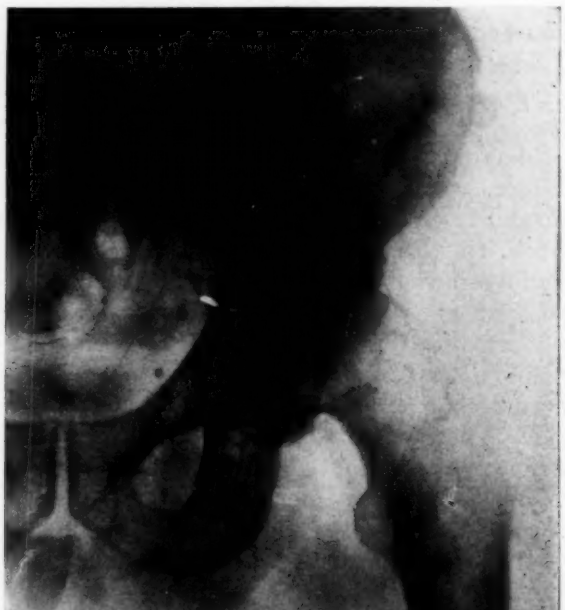

Fig. 2. Case 3. Right hip, before operation.

found, some of them containing actual pus, sterile on culture. It is possible that the condition known as morbus coxae senilis might be an end-result of pathological findings such as this.

The question as to the form of treatment for these patients depends largely on their general physical condition, age and occupation. In the very aged and feeble probably conservatism is best, and if the hip is immobilized in a light plaster spica the pain is relieved and life becomes a little more bearable. In 1921, Albee[3] of New York reported 128 cases of osteoarthritis of the hip-joint for which he had performed an arthrodesis. He was quite enthusiastic about his results. I believe in a later paper he pointed out that this operation was not very successful in the older patients. We know that

in osteoarthritis joint fusion is very slow and sometimes impossible to secure. The disease is a degenerative one and there is very little reason to expect bone union. Another factor which has to be considered is that most of these patients have an osteoarthritis of the spine which is also disabling and an arthrodesis of the hip increases the strain put upon the lumbar spine and consequently increases the pain and disability.

In 1922, Whitman[4] first reported a series of typical cases of morbus coxae senilis upon which he performed his reconstruction operation. The operation may be described in Whitman's words, as a mechanical adaptation of the hip-joint, disabled by injury or disease, to the essential requirements of locomotion. It was devised first for un-united fractures of the neck of the femur, particularly in those cases in which there was a good deal of absorption of the head. In the operation, the head of the femur is removed, and with an osteotome the great trochanter is cut across in a direction parallel with the neck of the femur. The muscular attachments to the trochanter are left intact. The neck of the femur is then reshaped so that it will fit into the acetabulum; no attempt is made to change the shape of the acetabulum itself. The trochanter is then pulled down and implanted on the outer surface of the shaft of the femur to restore the normal mechanics of the joint (Fig. 3). The leg is placed in abduction and held in this position until union is complete. Motion is then started. About a year ago, before the American Orthopedic Society, Whitman[5] reported another series of these cases with very pleasing results. A fairly good range of motion of the hip is secured and the patient is relieved of pain. In performing this operation for morbus coxae senilis, it is usually not necessary to completely remove the head of the femur, but merely to reshape it so that it fits into the acetabulum and will move freely in all directions.

Another operation for this condition was devised by Sir Robert Jones, but apparently has been practiced very little in this country. It consists of excising the great trochanter as in Whitman's operation, then dividing the shaft of the femur at the base of the attachment of the trochanter and fastening the trochanter to the distal end of the neck of the femur, thus making a pseudarthrosis between the outer side of the great trochanter, which has been turned under the neck of the femur, and the upper end of the shaft. It is hard to see how a hip on which this operation had been performed could be very stable.

Still another procedure sometimes used, consists of excising the head of the femur and reshaping the neck and fitting it into the acetabulum. This procedure also gives an unstable joint and one in which there is a tendency to recurrence of the adduction deformity, but there is probably less shock with this than with the other longer operations on the hip-joint and it can be used with comparative safety in aged and feeble patients. We have performed

Fig. 3. Case 3. Right hip, after operation.

a series of Whitman reconstruction operations under spinal anesthesia in which the factor of shock has been practically negligible even in old and debilitated patients.

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ABSCESS OF THE ORBIT*

W. T. GARRETSON, M.D.

DETROIT

WE have had several cases of this comparatively rare condition since this hospital opened. At present we have under observation a six-year old girl with a history of severe cold and much nasal discharge for a week or two before the onset of the present condition.

The symptoms of onset are:

1. Marked proptosis of the eyeball.

2. Impaired mobility of extrinsic muscles to which actual paralysis may be superadded.

3. Sight may not be affected, but may be reduced or entirely abolished.

4. Violent pains with very high fever—103 degrees to 106 degrees with or without cerebral symptoms such as headache, delirium, etc.

The diagnosis of orbital abscess is sometimes difficult. The following are significant:

1. Examination in the early stages of the fundus oculi may be of but little help as the disc is usually normal. Sometimes the veins show considerable engorgement, depending upon the degree of the intra-orbital pressure. If the eye is proptosed downward, this may be some aid in localization as the abscess may be in the upper part of the orbit.

2. A definite point of tenderness when pressure is made above, below, or at the inner or outer side of the eye ball. If the pain is referred above, it is probable that the abscess will be located in this region.

3. Redness of the eyelids with a little edema or ecchymosis of the conjunctiva without signs of conjunctival inflammation.

4. High fever associated with a cold and the above conditions.

Differential diagnosis must be made from cavernous sinus thrombosis as this condition is also associated with high fever, cerebral symptoms, proptosis, paralysis of the extraocular muscles and levator palpebrae superioris. This condition is frequently associated with boils or carbuncles on the face or at the base of the nose with extension to the orbital veins, thence to the cavernous sinus. The edema and swelling in this condition is due to blocking of the venous pathway with resultant engorgement of the orbital tissues.

The point of chief distinction aside from the history of boils or carbuncles, is sudden onset of complete blindness. However, one must remember that orbital phlegmons may produce secondarily cavernous sinus thrombosis.

Etiology. 1. Injury to the orbit by a penetrating foreign body or penetrating wound.

2. Transfer of inflammation from the walls of the orbit as in sinusitis, frontal, ethmoidal and maxillary.

3. Erysipelas. Transfer from the skin to the deeper tissues through the anastomosis of the orbital with the facial veins.

4. Metastatic infection from empyema thoracis, typhus fever, scarlet fever, purulent meningitis.

Among the causes, sinusitis is probably the most frequent and of the sinuses the ethmoid is the most common original focus. This is due to an enclosed empyema of the ethmoid cell with dehiscence of its very thin outer wall and a resultant extension of the inflammation through the orbital periosteum into the orbit. Frontal sinusitis is probably the next in frequency, as in enclosed empyema of the sinus the floor frequently necroses with a resultant abscess formation in the orbit posterior to the globe. Two years ago, we had such a patient who presented proptosis but with no actual abscess formation. This cleared up with external operation on this sinus. In maxillary sinusitis orbital plegmons are frequently due to dehiscence in the

* From the Eye, Ear, Nose and Throat Division of the Henry Ford Hospital.

roof of the maxillary sinus and with an enclosed empyema, pressure being sufficient to produce phlegmonous inflammation of the orbit. Occasionally in osteomyelitis of the superior maxilla, secondary to alveolar abscess, pus may force its way beneath the periosteum, producing an abscess of the orbit.

Course. 1. The orbital phlegmon may subside spontaneously with absorption of the exudate and return to normal of the protruded eyeball. However, frequently there is a residual slight proptosis or enophthalmos.

2. Often there is slight paralysis of the external muscles due to involvement of the oculomotor nerves.

3. Orbital phlegmons may give rise to involvement of the optic nerve by inflammation of vessels, as the ophthalmic artery, which enters the optic nerve from without, one and one-half inches posterior to the globe. If the orbital plegmon is in the posterior part of the orbit the last ethmoid cell may be a focus, acute neuritis with atrophy of the optic nerve may be the result for the last ethmoid cell forms the outer boundary of the optic foramen. Panophthalmitis occasionally forms as a result of suppuration in the choroidal veins.

4. Detachment of the retina, purulent meningitis and brain abscess may result from this inflammatory condition.

Treatment in this condition is to try to remove the cause, as follows:

1. Treatment of septic wounds of the orbit.

2. Provide for the escape of secretions from the wound.

3. Removal of foreign body.

4. Treatment of suppurative osseous conditions in the neighborhood—such as ethmoid, frontal and maxillary sinusitis. Frequently nasal operations on the ethmoid will be sufficient to drain the orbital abscess without any actual entering of the orbit itself. If an abscess develops, it should be opened as soon as possible. The point of entrance should be at the point of localization of tenderness and swelling. Very frequently an actual pus pocket is not found owing to the failure to localize. If no pus is found, however, the operation is not a failure in that relief of tension of the orbital tissues is thus obtained to prevent further protrusion of the eye and possible necrosis of the cornea from pressure of the overlying eyelids.

Statistics. I have found no definite statistics in the literature, which I have carefully searched. Doubtless no one had had sufficient personal experience with this class of cases to justify statistical results.

In the several cases that we have had, one patient has complete atrophy of the optic nerve as a result of the orbital phlegmon. The remaining ones have good vision, including this patient.

The important point which I wish to stress is that the sudden onset of proptosis without evident inflammation of the lids, associated with the conditions previously mentioned—severe cold, erysipelas, sinus infection, and alveolar abscess and with high fever, frequently means orbital suppuration.

Treatment is urgent.

1. Diagnosis of the etiological factor must be made and treatment undertaken at first through the etiological factor, as in sinusitis.

2. If sinusitis is the etiological factor treatment should be directed toward the ethmoid sinus. An incision as for external frontal and ethmoidal sinus operation is the most favorable approach in that it provides room for exenteration of the ethmoids and investigation of the frontal sinus if the diagnosis should be in doubt.

In this most recent case we found inflamed periosteum over the region of the ethmoid cells. Cultures from both the orbits and this inflamed periosteum showed streptococcus hemolyticus.

The patient, aged six years, was brought to the hospital May 14, 1926. She gave a history of an acute cold for a week or two and two days before admission the right eye became very much inflamed and proptosed. The lids were

closed and very much inflamed. The eye protruded almost 1 cm.

Under ethylene gas, incision was made in the eyebrow extending from the left of the supraorbital nerve in front and below the inner canthus. The periosteum was elevated over the os planum. The posterior ethmoid cells were found to be very markedly diseased and opposite to them there was an erosion of the periosteum. This was incised, a small forceps was introduced, about 1 dram of pus was evacuated. Free entry way into the nose was secured by removal of all ethmoid cells opposite this. No attempt was made to do any nasal work. A rubber dam drain was inserted. The temperature did not reach above 101 degrees following this. She was dressed every two or three days and on June 12, the wound had completely healed. There is fairly good movement of the eye in all directions. Culture showed hemolytic streptococcus.

Discussion

Dr. E. L. Whitney: I saw a man two or three years ago who had a phlegmon of the orbit. I never could demonstrate a sinus abscess, although I thought possibly that was what was wrong. He had no pus in the nose, and the sinuses were clear to transillumination. When he got over his influenza he came to the hospital. The proptosis disappeared in a month, and he again had normal vision.

MULTIPLE ADENOMA OF THE THYROID COMPLICATED BY TULAREMIA*

A. B. McGRAW, M.D.

DETROIT

THE following case is reported solely on account of the interesting association of two conditions, one of them common enough in this region, the other rare; and because the results of treatment to date seems to justify the way in which the problem presented was met.

The patient, Case 88195, is a housewife, aged forty years, of German-American stock, married for nineteen years and mother of six children, admitted to the Henry Ford Hospital on January 26, 1927.

Chief Complaint. Suppurating glands in the right elbow region and a painful swelling in the right axilla.

Present Illness. Two months ago two lymph nodes in the right epitrochlear region became swollen, tender, and fluctuant. At the same time the patient experienced a couple of days of general malaise of unexplained origin, associated with nausea, vomiting and feverishness. The glands were lanced several times by the patient's family physician with the evacuation of pus and relief of local symptoms, but had refused to heal. Within the past week a tender swelling gradually appeared and increased in the right axilla. During the past year nervousness, asthenia, and tachycardia had been noticed in increasing degree but had been much more marked during the past two months. There was a loss of 20 pounds in weight noticed during the year.

Past History. Measles as a child. No injuries or operations. Eight pregnancies (including two miscarriages) in nineteen years. Otherwise negative.

Family History. No known cases of goiter, diabetes, or cancer. Mother died of tuberculosis.

Summary of Physical Findings.

General. A slightly emaciated middle-aged woman, looking chronically sick. Obviously nervous and restless. Temperature 99° F. (mouth), pulse 140, respiration 22.

Eyes. Moderate staring. No exophthalmos, von Graefe, Moebius, or Stellwag signs. Fundi normal. Ametropia.

Ears and Nose. Negative.

Mouth and Throat. There had been recent extractions of all teeth.

Lungs. Negative to percussion and auscultation.

Heart. No enlargement, murmurs, irregularity of rhythm, or electrocardiographic signs of myocarditis. Rather marked sinus tachycardia.

Abdomen. Negative.

Pelvis. Moderate scarring from lacerations of cervix. Marked chronic cervicitis, and leucorrhea.

Rectum. Negative.

Reflexes. Hyperactive.

Lymph Glands. (a) Right epitrochlear region. Two slightly enlarged and semifluctuant glands each with a small recent incision, the edges of which are glued together if not actually healed. These glands were neither tender nor red, on admission.

(b) Right axillary region. What felt like a single enlarged, fluctuating gland in the lower axilla, $2 \times 2 \times 3$ cm. in size. The overlying skin only slightly red and tender.

(c) Other groups of glands, not enlarged, not tender.

Extremities. Marked fine tremor of hands.

Thyroid gland. Irregular nodular enlargement, three to four times natural size, involving both lobes and isthmus of the gland, especially the left lobe. On the left side the enlargement of the lower pole extended beneath the clavicle.

Routine Laboratory Findings. Blood Wassermann reaction negative. W.B.C. 9050; Differential, P.M.N. 69 per cent; P.M.E. 6 per cent; S.M. 18 per cent; L.M. 7 per cent; Urine: sp. gr. 1025: albumin negative; sugar, negative; microscopic, W.B.C. 1 plus.

Other Laboratory Tests. Basal metabolic rate plus 75 per cent; blood chemistry: N.P.N. 27.3; Urea nitrogen 14.9; blood sugar 108; blood culture, no growth.

Comment. The combined symptoms of marked nervousness, tremor, tachycardia, loss of weight, asthenia and staring expression, coupled with a high basal metabolic rate made

* From the Surgical Department of the Henry Ford Hospital.

a diagnosis of hyperthyroidism obvious and easy. The indicated treatment for this condition, a period of rest followed by thyroidectomy, was equally obvious. The diagnosis of the nature of the axillary abscess for which she had entered the hospital was not as obvious and might easily have been overlooked had not another case of tularemia been seen in the hospital some three weeks previously. The rather slow development of the axillary mass, preceded by two indolent epitrochlear abscesses was decidedly unlike a streptococcus infection. A staphylococcus infection could not be ruled out, however. Questioning revealed that the patient had bought in the open market, prepared, cooked and eaten rabbits on at least three occasions during the Fall of 1926. This, coupled with the history of a small infected scratch on her right hand, followed by a spell of vague general malaise, then the epitrochlear abscesses and finally the axillary abscess made a diagnosis of tularemia highly probable. A specimen of the patient's blood was sent at once to the laboratories of the U. S. Public Health Service at Washington and the following report obtained: "Serum agglutinates with B. tularensis in a dilution of 1/160, not complete in a dilution of 1/320. No agglutination with B. abortus."

Course in Hospital. On the day following admission the axillary abscess was opened under ethylene-oxygen anesthesia and about 35 c.c. of thick yellowish, odorless pus was evacuated, entirely relieving the patient of her painful symptoms. We hoped that the abscess cavity would heal within a week or so and thus allow us to proceed with a thyroidectomy which she badly needed. It not only showed a very sluggish tendency to heal but both epitrochlear glands began again to show signs of fluctuation. A check on her basal metabolism on January 31 showed a rate of plus 32, but the patient was steadily losing weight and her ability to resist infection seemed on the decline. Confronted with the dilemma either of performing a clearly indicated and presumably clean operation in the presence of an active infection elsewhere, or entering on an indefinite period of treatment of the tularemia abscesses, we felt that relief of the hyperthyroidism and the improvement it would surely bring to the patient's general health was worth the risk of a wound infection. On February 2, 1927 a subtotal bilateral thyroidectomy was performed removing all adenomata and leaving but a very small trace of thyroid tissue. The operation was well stood by the patient, and we were delighted to observe that the wound seemed to heal entirely without reaction or sign of infection. The two epitrochlear glands were reopened on the day the thyroidectomy was done, and both they and the axillary abscess were practically healed by the time the patient left the hospital on February 13, eight days after operation. On the day before discharge a basal metabolic reading was plus 6 per cent. On April 15, 1927, the rate was minus 10 per cent, and she has been started on a dose of ½ grain whole thyroid a day. This has since been discontinued.

Postoperative Course. Three days after discharge from the hospital the patient returned to the clinic with a puffy, fluctuating, tender, red area on the right side of the neck at the scar line, about 2 × 3 cm. in size. She was questioned closely but was sure there had been no sign of it until the night before. The fluctuating area was incised under local anesthesia and about 20 c.c. of pus evacuated, similar in character and appearance to that from the axillary abscess. A culture of this pus grew only a Gram negative bacillus. This wound was dressed every 2 or 3 days, and healed within ten days. Whether this wound infection was caused by the B. tularensis or not is of course entirely a matter of conjecture, but with the coexisting abscesses in axilla and arm, it seems quite possible that it was.

UNRUPTURED INTERSTITIAL PREGNANCY*

H. M. NELSON, M.D.

DETROIT

IN the following case an attempted criminal abortion in an apparently normal pregnancy was followed by what was thought, to be a normally progressing pregnancy.

Mrs. R. H., white, aged twenty-nine years, had been married ten years, and had three children living and well, the fourth, born in 1919, having died after five months of pneumonia. She had had one early abortion without complications. All the labors and puerperia were normal.

Menstruation began at the age of 14. It is of the twenty-eight day type, lasts three days, and the flow is moderate, and without pain.

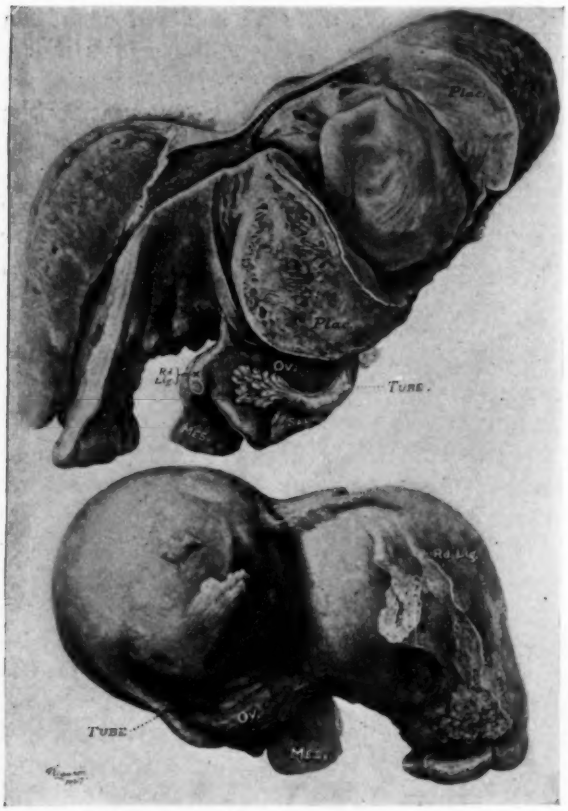
The patient's last menstrual period ended February 5, 1925. In April she used "slippery elm sticks" to induce an abortion. The next day she had some uterine bleeding, followed in two days by chills and fever and general malaise.

On April 22 she was admitted to the hospital. There was generalized tenderness throughout the lower abdomen. The fundus was large and very tender with marked induration and tenderness in the region of both adnexae. A diagnosis was made of pelvic peritonitis, metritis and perimetritis. Her hemoglobin was 52 per cent, W.B.C. 11,500, P.M.N., 79 per cent. Her temperature was 100° F., pulse 110, respirations normal. She remained in the hospital for eight days, at the end of which time her temperature returned to normal, and she was feeling quite well. She was seen again in the Out-Patient Department June 14, because of a severe pain through the lower abdomen, more marked on the right side. At that time the vaginal mucosa was blue, the cervix was enlarged and soft, there was a mass which rose within a finger breadth of the umbilicus. This mass was irregularly softened and felt like a normally progressing pregnancy. Because of the temperature of 99.4° F. and the severe pain, the patient was again admitted to the hospital. Her temperature soon fell to normal, and she was discharged at the end of the second day.

On July 2 she was examined again. The uterus seemed about the size of a five months' pregnancy. There was great tenderness in the region of both tubes and ovaries, more marked apparently on the left side. Her temperature was 99.8° F., and she complained of some frequency and dysuria and pains in the left lower quadrant. On July 21 the patient began having a few cramps, which were followed by a bloody vaginal discharge. July 23 she had a sudden gush of fluid. The next day the uterus was a little smaller than formerly, and there was less tenderness in the abdomen. We thought at that time that the patient would abort. On August 20 she was examined again, and the uterus seemed definitely smaller than previously. The patient said she had been having a foul-smelling brownish discharge, with some bright blood at times. When seen in September she had been feeling quite well; there had been a little bright red discharge; the uterus was definitely smaller, but still considerably larger than normal. She was examined the first of October. At that time the uterus was about the size of a three months' pregnancy and rather hard and freely movable, and the cervix was closed. She returned to the hospital October 15, stating that for the previous twenty-four hours she had been having considerable bleeding. The uterus was about the same size as that at the last examination, at which time it was felt that the patient should be curretted, and this was done in August. The left wall of the uterus seemed about normal thickness. The right cornu was about 2 inches thick, feeling like an intramural fibroid in this region. The uterine cavity itself did not contain any product of pregnancy. It was curretted, but nothing abnormal was obtained. Pathological examination showed no suggestion of fetal tissue. The patient made an uneventful recovery from this, and left the hospital three days later. On November 19 she returned. The enlargement in the right cornu of the uterus was about the size of a baseball. It was discrete, firm and not tender. The uterus was quite movable. We made a diagnosis then of fibromyoma of the uterus. In December she was examined again, and at that time we advised operation for fibromyoma.

* From the Gynecological Division of the Henry Ford Hospital.

On December 30, 1925, hysterectomy, appendectomy and a right salpingoophrectomy were performed. The note dictated at the operation was as follows: "In the pelvis the fundus is distorted by a large fibromyoma in the right cornu which has undergone considerable degeneration. The omentum is implanted on the tumor and supplies part of its circulation. There is a softer pedunculated fibroid in the left broad ligament. The fibroid at the cornu of the fundus involves the area at the base of the tube and the round ligament so that it seems necessary



Two drawings of the specimen after it had been fixed: the upper one showing the fetus in place; the lower one a posterior view.

to remove the whole uterus in order to care for the broad attachment of the fibroid. Right tube and ovary are removed together with the uterus."

The pathological examination of the specimen showed: "The uterus is slightly enlarged, 12 cm. long. At one cornu the adnexae are missing. At the other cornu there is a globular mass the size of a baseball that is not pedunculated but forms a thick based continuation of the uterus. From this mass the patent tube can be followed to its open fimbriated end. The ovary is of fair size and pale with several cysts in it. The uterine canal is somewhat wider, also the mouth is more open, than usual. The endometrium is smooth, pale and clean. In the fundus a thin, elongated, mucous polyp can be seen. The wall is everywhere thick and succulent with dilated vessels. At the cervix the thickness of the wall is 11 mm., increasing until in the fundus it is 22 mm. The mass in one cornu is covered with dry and yellowish peritoneum. The mass feels finely nodular and hard, giving the impression of a neoplasm undergoing necrosis and calcification. On cut section it is found to consist of an interstitial pregnancy of the tube at the point of insertion of the latter into the uterus. The placenta is showing necrosis and the fetus, maceration and necrosis."

The patient made an uneventful recovery from the operation, and was discharged November 15.

Next to ovarian pregnancy interstitial pregnancy is the rarest form of ectopic gestation. According to Rosenthal,[1] who has reviewed over 1300 cases there were only 3 per cent interstitial pregnancies. Wynne[2] thought that the percentage was much less than that and in 304 cases he found only 1.5 per cent interstitial.

A positive diagnosis of interstitial pregnancy before rupture is very difficult and is quite impossible after rupture because the symptoms are identical with those of a ruptured tubal pregnancy. The diagnosis before rupture depends upon the usual ectopic history, the associated signs of pregnancy and particularly the detection, upon vaginal examination, of an irregular enlargement extending around one uterine horn, with a broad base upon the uterus. The enlarged area may be very firm, from tension, and give one the impression of a fibroid. In most of the cases reported the pain is early and usually develops before bleeding or death of the ovum takes place.

Because of the rich blood supply at the cornu of the uterus severe hemorrhages are apt to occur at rupture. Wynne gives the mortality as 11.9 per cent.

The treatment is always surgical,

whether ruptured or not. Very few cases of unruptured interstitial pregnancies have been operated on. Rupture generally occurs early, between the second and third month.

The type of operation should be selected to fit the emergency. Hysterectomy is usually preferred. Excision of the cornu may be done more quickly in moribund cases.

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TRANSACTIONS OF
THE SECTION OF SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of April 1, 1927

THE CHAIRMAN, DR. FREDERIC W. BANCROFT, PRESIDING

THE IMPORTANCE TO SURGERY OF THE CYSTIC DUCT

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NEW YORK

IN the course of a study of the cystic duct of the human being and its possible relation to the normal function and also to the pathology of the gall bladder, certain questions have arisen, the answers to which would seem to be of particular interest to the surgeon. I have reached the tentative conclusion that the symptomatology of gall-bladder disease depends upon the degree of the direct or indirect involvement of the cystic duct; or, to put this statement in the form of its corollary, that the gall bladder itself is not the point of origin of symptoms. One definite example of this possibility is that a gall bladder, filled with the stones which have been called "innocent" gall stones—which are, indeed, innocent of immediate symptoms, however lacking in innocence in respect to future processes they may be—will show no symptoms whatever; while one single stone caught in the cystic duct will call forth the characteristic train of symptoms.

It may be called an axiom of the surgery of the intra-abdominal organs that pain is an expression of tension. This is not only true of intra-abdominal surgery, for that matter, for the analysis of pain in any portion of the body leads to this concept of tension. Just as the stomach can be cut, sewn, burned, causing no pain so long as tension is not exerted on the structures which hold the stomach in position, so the gall bladder can be operated upon without causing pain, provided tension is not exerted upon the suspensory apparatus. The portion of the gall bladder and cystic duct that possesses the least mobility and that is least able to be expanded without tension upon surrounding structures is the cystic duct, lying as it does enclosed in the ligamentum hepatoduodenale.

The anatomy of this region has been elaborately described by Lütkens[1] in his recent book "Structure and Function of the Extra-hepatic Biliary Passages." Time does not permit a discussion of these details and I refer those interested to this exceedingly valuable volume.

The general outline of the anatomy is seen in the schematic drawing (Fig. 9), which shows the division of the gall bladder into the body, the fundus being the portion of the gall bladder that hangs below the liver edge and is not always present, the infundibulum, to which is attached, often broadly and intimately, the neck, which in turn passes into the cystic duct. Lütkens divides the cystic duct into two parts: a smooth portion, joining the hepa-

PLATE I

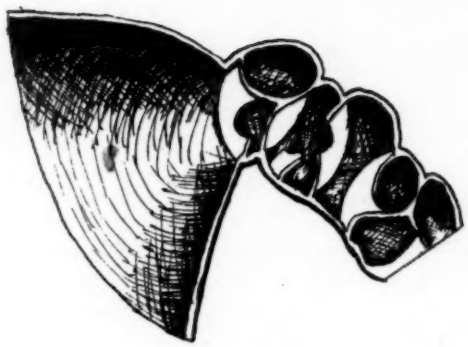

Fig. 1

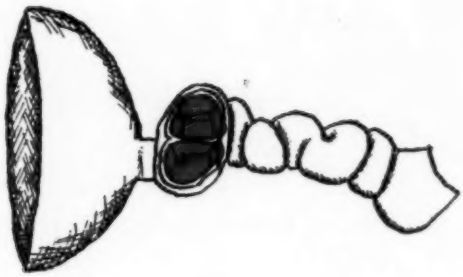

Fig. 5

Fig. 2

Fig. 6

Fig. 3

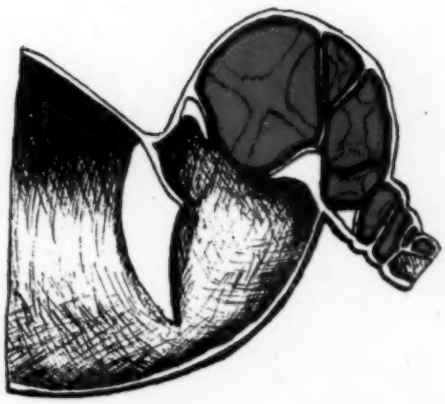

Fig. 7

Fig. 4

Fig. 8

The division of the cystic duct into pockets by the valves of Heister, and the manner in which these pockets determine the size and shape of the multiple facetted gallstones.

tic, and a valvular portion joining the neck of the gall bladder. At the point where the valvular portion of the cystic duct joins the collum, Lütkens describes a sphincter muscle.

This brief résumé of Lütkens' description will suffice, at least, to point out that the various students of the gross anatomy of the cystic duct do not all think alike. It seems to have been always thus, for Heister,[2] who first described and pictured the valves of the cystic duct, mentions that Glisson, the English anatomist who died a few years before Heister was born, had never encountered these valves. Lütkens sees valves only in the portion of the cystic duct nearest the gall bladder. Mentzer[3] seems to attach little importance to the valves of Heister and says that there were none at all in eight of his cases. On the other hand, in my own studies every specimen in which the cystic duct is complete shows the valves extending clear to the junction with the hepatic duct. In other words, there is no smooth portion of the cystic duct, no portion free of valves.

As regards Mentzer's findings and conclusions, I have never found a specimen from the human being which fails to show these valves of Heister. They vary greatly in their number and complexity, they may be much smoothed out by the dilatation of the duct that follows the impaction of a stone, but they are always present. These valves are not found in any animal that I have been able to study. I suspect that the differences in findings that have been reported depend upon differences in the choice of the method of study. The method used by Heister has given the best results in my hands—the oldest method for making permanent specimens of the hollow viscera, simply to blow them up with air and then let them dry. A cannula is tied into the common duct or the fundus of the gall bladder, the organ is distended with air to its normal size, the peritoneal covering and the underlying fat are removed and the specimen is allowed to dry in the air. The removal of the fat is simply to insure the permanency of the specimen. This simple method suffers somewhat from the fact that a certain amount of shrinkage takes place on drying, an objection which may be partly obviated by leaving a constant pressure on the specimen while it is drying. This is accomplished by interposing the rubber balloon of the ordinary cautery bag between the source of air pressure and the gall bladder, and allowing the distended rubber bag to supply counter-pressure against the shrinking effect.

The second best method in my experience is to distend the specimen with formalin and then to immerse this distended object in formalin. This method gives very excellent results. It makes it unnecessary to dissect off the fat, and preserves the specimen in such condition that microscopic studies can be made if desired. The objection is that formalin specimens are not very pleasant things with which to work. With either method, the specimen is cut into halves as accurately as possible to show the internal arrangement.

A combination of these two methods may be used to bring out certain features which neither of the described methods alone shows so clearly. The specimen is distended with formalin and fixed in toto without any dissection. After fixation the specimen is dissected, filled with air and dried. This method preserves the normal curves of the cystic duct as shown in Figures 10 and 11, in which also the apparent narrowing of the duct at one point together with the more or less complete turn of the duct at this point can be seen. In such a specimen, if it is desired, the blood vessels may be left and will show how these curves of the cystic duct seem to be maintained by the blood vessels which, arising from the level of the common and hepatic ducts, cross to the infundibulum of the gall bladder in a perfectly straight line.

That this choice of method is of basic importance, is seen, I believe, in Lütkens' own work. The pictures he gives of roentgen-ray studies of the cystic duct (Fig. 12)

show distinct evidences of valves in the cystic duct clear to the common duct; while his pictures of fresh specimens (Fig. 13) show what might be interpreted as a smooth portion. Mentzer's work, if we may judge from his illustrations, was carried out either with fresh specimens or with ordinary formalinized material (Fig. 14).

Figure 15 brings out another point concerning the method of study. The upper portion of the figure is a drawing of a

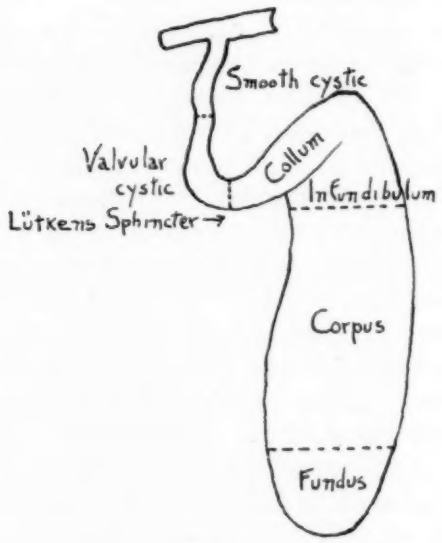

Fig. 9.

dried specimen with a silk thread carried through the openings from one chamber to the next to bring out the fact that the actual channel of flow through the cystic duct is far more tortuous even than are the actual twists and turns of the cystic duct. It also shows why the surgeon has difficulty in passing a probe through the cystic duct. The lower part of this figure is a photograph of the same specimen which shows how inadequate is photography to bring out the details. This difficulty is based upon two things, the half round shape and the lack of color contrast.

There is some evidence in the literature (Higgins and Mann[4]) that points to the existence in the cystic duct of some sort of a sphincter. My own studies have impressed me with the fact that there is a distinct narrowing at about the middle of the cystic duct and that this narrowing coincides with a complete turn or a U-shaped bend in the line of flow of the cystic duct, meaning by this the line which may be followed by passing a thread through the openings from one chamber to the next.

My conclusions concerning the cystic duct of the human being are: first, it is an extremely tortuous tube containing on the inside, throughout its entire length, an arrangement of folds of mucous mem-

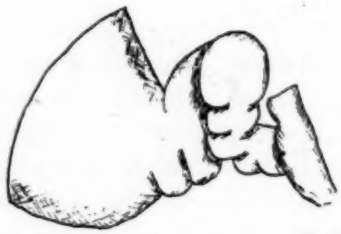

Fig. 10.

Fig. 11.

brane which are placed in a more or less spiral fashion, but which divide the cystic duct essentially into a series of little chambers. The openings from one chamber into the next are not opposite each other but are so placed that the channel of flow is even more tortuous than would be determined by the external form alone; second, the actual number of these valves is inconstant and the shape of the chambers formed by them is never the same in any two specimens; third, the purpose of this curious arrangement is not clear. It might be a mixing device. It might be a device to impede the flow of bile from the gall bladder. Such an arrangement would offer resistance in direct relation to the viscosity of the fluid flowing through it; and there can be no question, from the work of Rous and McMaster, that bile flowing out of

the gall bladder (if bile ever normally flows out of the gall bladder) would possess at least ten times the viscosity of bile flowing into the gall bladder, since it is at least ten times as concentrated as liver bile.

Whatever the normal function of these little chambers along the cystic duct may be, I am convinced that their size and shape determine the size and shape of the multiple facetted gall stones found in the gall bladder. Without exception in every gall bladder containing multiple facetted gall stones that I have obtained with ducts attached, the multiple facetted stones found in the gall bladder were seen to fit into the pockets along the cystic duct and the neck and infundibulum of the gall bladder; and the shape of these pockets may be predicted from the form of the stones found in the gall bladder. I believe that these stones must arise as soft masses which lodge in these pockets and conform to the shape of the pocket. Chemical processes take place that change this colloidal mass into so-called stones. The cystic duct becomes blocked. The pressure which we know causes a dilatation of the entire extrahepatic duct system after cholecystectomy, in the presence of a competent sphincter of Oddi, forces the stone out of the cystic duct into the gall bladder, since the blocking of the duct by the stone has produced a functional cholecystectomy. The process then repeats itself until we may find a large collection of stones all of the same size and shape, or of varying sizes and shapes, according to the character of the pockets formed by the valves of Heister.

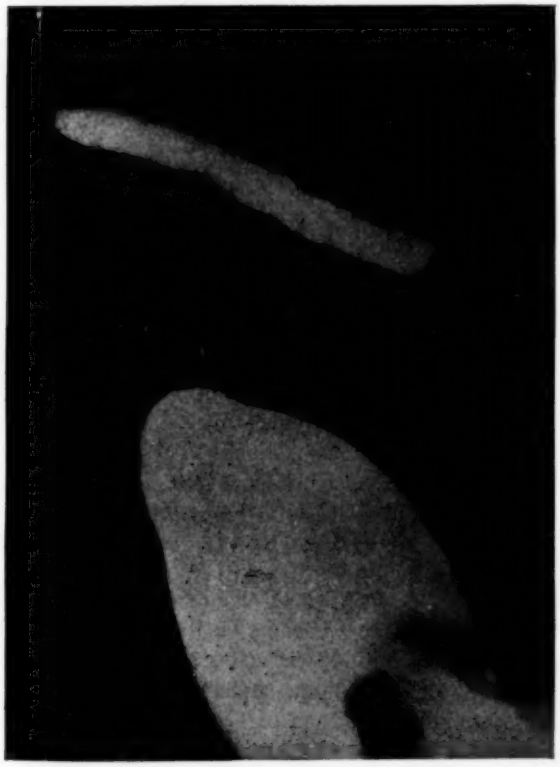

Fig. 12.

Fig. 13.

The same difficulty presents itself here as in the study of the cystic duct in the matter of the method of presentation of the results. Photography is the proper and preferred method in scientific work, but it has proven entirely unsatisfactory.

I therefore present my results in the form of pen and ink drawings in which I

bring out the gall stones by the use of a simple contrasting color. It is to be understood that this is not the natural color of the stones under consideration but is chosen merely for contrast. Figure 1, Plate 1, is presented to show the depth of the pockets along the cystic duct, as well as the tortuous channel of flow of the bile from one chamber to the next. Figure 2 brings out the same point with the aid of a silk thread following the channel of flow and also shows how these pockets may

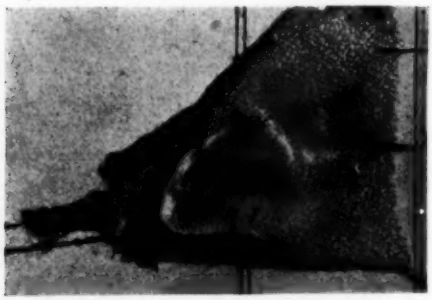

Fig. 14.

occur along the wall quite outside the channel of flow. Figure 4 shows a similar pocket containing a gall stone. Figure 3 presents a gall bladder containing numerous black "mulberry" masses of pigment. These masses were all characterized by a dumb-bell shape and all seemed to fit this portion of the cystic duct as shown in Figure 3. Figure 4 presents a gall bladder containing 18 stones composed of the same material as the mulberry stone in Figure 3, but in the case shown in Figure 4 the stones are flat with smoothly rounded edges and no suggestion of the mulberry type. This specimen shows very curious pockets on the wall of the infundibulum in which the stones seemed to fit.

Figure 5 presents a gall bladder which contained one large round stone of the size of an English walnut, 3 smaller stones of about one-third the size of the large stone, and 12 small stones, peculiar in that each possessed one plain surface, which surface was free of a coat of black

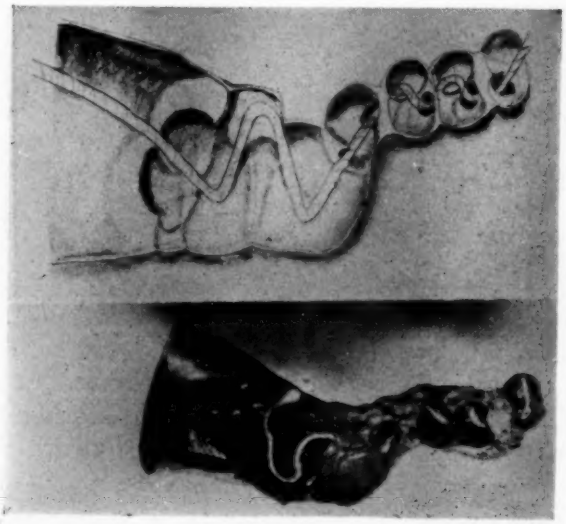

Fig. 15.

pigment that covered the remainder of the stone. It would seem therefore that this plain surface had been in such a position that no pigment could be deposited upon it. On preparing this specimen, 2 pockets were found at the junction of the gall bladder and the cystic duct into which these little stones exactly fit. This gall bladder was peculiar (Fig. 6) in that the valves of the infundibulum had apparently become injured, and on healing left only 2 pin-hole apertures, through which bile gained access to the gall bladder. Figure 7 presents a gall bladder containing a large number of stones of different size and shape which fit accurately the pockets of different size and shape along the cystic duct. The very small stones in Figure 7 fit little pockets that are outside the stream of bile. Such pockets seem to be not unus-

ual. In Figure 2 the pockets in the beginning of the gall bladder lie outside the stream of bile. Figure 8 shows a gall bladder containing 500 small stones of varied size, among them several very small stones which seem to fit accurately this side pocket.

If I am correct in the ideas I have presented, the cystic duct is of importance to surgery because it is the area in which tension produces the characteristic train of symptoms. This tension is the stretching of the wall of the cystic duct by the secretory pressure of the liver working against a competent sphincter of Oddi, the gall bladder being closed by a stone that has formed in the pockets of the cystic duct, behind the leaflets of the valve of Heister.

Gallstones become impacted in the cystic duct not on their way out of the gall bladder, but on their way into the gall bladder. This same pressure acts after the surgical removal of the gall bladder as well as after the just described functional removal of the gall bladder by a stone, and if the cystic duct is left behind, the same symptoms will persist after the cholecystectomy.

We are familiar with the reason why surgeons do not remove the cystic duct in the operation of cholecystectomy—the fear of injuring the common duct and the consequent irreparable stricture. Nevertheless, if I am correct in my surmise, this failure to remove the cystic duct leaves just that portion of the system which produced the original symptoms and will probably continue to call forth symptoms until the physiological processes involved shall have adjusted themselves.

I present for surgical discussion two thoughts: the more complete removal of the cystic duct; or, making the sphincter of Oddi incompetent by section.

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Discussion

Dr. John C. A. Gerster: It is very interesting to consider what Dr. Sweet has just told us in conjunction with a lecture by Prof. Aschoff in which the latter called attention to the fact that cholecystectomy did not always relieve the patient of stones and that the cause was probably due to some embarrassment of the autonomic nervous system. Does Professor Sweet know of any cases where, a few months after cholecystectomy, the patient had a typical gallstone attack accompanied by fever and jaundice and where after one or two attacks, the common duct has been opened and no stones found, merely a few cholesterin crystals floating around in the bile or, at times, tiny, round calculi the size and shape of shad roe?

Dr. Morris K. Smith: The reports of the results of cholecystectomy in the literature have been, on the whole, good. Although I have never tried to remove the cystic duct, and have at times in acute cases left a little of the neck of the gall bladder, my own experience has been that a large percentage of good results may be expected.

Dr. Frederic W. Bancroft: We have all seen symptoms following cholecystectomy similar to those of previous attacks. It is my impression they are caused by high fixation of the duodenum. It has a tendency to be drawn up toward the stump of the cystic duct by contraction of scar tissue.

If the patient has been guilty of some dietary indiscretion and vomits, pain is probably produced by the pull on the adhesions. Roentgenography of the gastrointestinal tract usually reveals the lesion. I have operated on several of these patients, by freeing the duodenum and obtained satisfactory relief of symptoms. This would lead one to assume that not every case of pain following cholecystectomy is due to elongation of the stump of the cystic duct or to reformation of gallstones in the stump of the cystic duct or the hepatic duct.

Dr. Bradley L. Coley: Has Dr. Sweet data on the reformation of gallstones in gall bladders that have been subjected to cholecystostomy? A knowledge of the frequency with which gall bladders from which stones

have been completely removed by cholecystostomy reform stones would be of interest because if this occurs in any considerable proportion of cases it would be one more argument in favor of cholecystectomy rather than cholecystostomy.

Dr. Frederic W. Bancroft: Answering Dr. Coley, about two years ago Cameron reported in the *Journal of the American Medical Association* the case of a patient who had had careful removal of stones through a cholecystostomy was reoperated on in three months and the gall bladder was found filled with stones again.

Dr. Sweet (closing): It is a difficult matter to discover the concensus of opinion among clinical surgeons as to the actual results of operative procedure upon the gall bladder. Many surgeons seem to be well satisfied with their results, and yet the reports in the literature give results quite comparable to the large series reviewed by Deaver and Bortz[1] which shows only 65 per cent of cholecystectomies in which the condition was entirely relieved. Dr. Smith said he did not see how the cystic duct could produce the symptoms because it is fixed and immobile. I believe that it is probably this fixation and immobility that determine the site and origin of the symptoms. The problem of the formation of gallstones is not a problem merely of infection or of bile stasis, but one involving the metabolism of cholesterol, concerning which we as yet know nothing. It is a clinical problem since animals do not show concretions containing cholesterol. The problem of gallstones is therefore one which needs for its solution the interest and cooperation of the clinical surgeons.

[1] Deaver, J. B., and Bortz, E. L. Gall bladder disease. *J. Am. M. Ass.*, 1927, lxxxviii, 619.

THE MECHANISM AND PATHOGENESIS OF ACUTE OSTEOMYELITIS

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THIS presentation is a résumé of several previous communications[1,2,3] in which the mechanism and pathogenesis of acute osteomyelitis were described; it is based on the conception that acute hematogenous osteomyelitis is a metastatic lesion during the course of a bacteremia, the latter resulting from an acute bacterial lesion on a surface of the body which forms the portal of entry for the infection. In this conception a surface of the body includes not only the skin, but also the entire mucous membrane of the alimentary tract, the genitourinary tract, etc. The common surface lesions include not only furuncles, carbuncles, etc., on the skin, but also lesions in the tonsils, and elsewhere, lying in the mucous membrane of the pharynx as well as less demonstrable lesions, as in Peyer's patches.

The fundamental cause of the spreading of the original lesion in the form of metastatic or subsidiary lesions is an infected thrombus lying in the original area of infection, and communicating at some point with the freely circulating blood. Organisms, growing on the surfaces of the thrombus, are discharged, or pieces of the thrombus itself break off and are discharged into the circulation and, becoming lodged for various reasons in the vascular network of various parts of the body, give rise to secondary lesions. Bone tissue, because of its peculiarities in vascular structure, seems particularly prone to the blocking of these thrombo-emboli and the susceptibility to this is particularly increased during the period of growth when the individual bones contain well-marked divisions into diaphysis and epiphyses.

The various accessory causes, such as trauma, that determine the localization of a secondary focus of infection—fixation point—in a given bone, are associated with accidents in the local circulation which facilitate blocking of any bacterial thrombus-embolus. The essential nature of the pathologic process that develops at the fixation point is a thromboarteritis or thrombophlebitis, in which a dominating position is assumed by the secondary vascular thromboses which must necessarily occur in such a pathological lesion. The all-important secondary effect which these thromboses produce are disturbances of essential nutrition which lead to the death of certain bone cells and the consequent necrosis of certain areas of bone tissue.

The resultant lesions are understood only in the light of complete knowledge of the structure of the vascular tree of the given bone. A typical specimen of the circulation in a long bone is shown in Figure 1. There is a separate circulation for the diaphysis and for the epiphysis. The circulation of the epiphysis enters most often at more than one point, and among these, oftentimes a main channel can be distinguished.* The epiphyses (Fig. 2) obtain their blood supply from the periosteal network of arteries, large branches of which perforate the thin layer of compact tissue on their exterior, and are distributed throughout the spongy cancellous tissue. Practically the whole of the blood supply is therefore independent of

* In the hip joint the blood supply of the epiphysis which forms the heads of the femur is derived from a single vessel which passes to it in the ligamentum teres: The vessel is the terminal part of the transverse branch of the internal circumflex artery, a derivative of the deep profunda branch of the femoral artery.

that of the diaphysis. Only one or two minute vessels pass into the epiphysis from the diaphysis through the conjugal cartilage. This accounts for the comparatively infrequent occurrence of necrosis of the epiphysis in traumatic separation of the epiphysis even when the latter is more or less completely displaced from the diaphysis. The circulation of the diaphysis is derived from a large vessel, the nutrient artery of the bone, which enters a little to one side of the center of the shaft. Immediately, the main vessel divides into a number of large branches which pass, some of them upwards and some of them downwards, towards either end of the shaft. A diffuse network is formed which supplies the entire interior of the bone and its medullary cavity. Towards the end some of the main branches become end-vessels. There is a free anastomosis between the plexus of vessels thus established and the vessels derived from the periosteum through Sharpey's fibers. In a growing bone, with the epiphyseal cartilage still present, the little direct anastomosis between epiphysis and diaphysis results in a relative avascular area; in a fully grown bone there is an extensive anastomosis between the two.

The avascular area in a growing bone results from the termination of the epiphyseal and diaphyseal circulations within a short distance of the epiphyseal line (Fig. 2). The terminal vascular network on either side is made up of vascular loops which result from the free and extensive anastomosis (1) on the epiphyseal side of the various vessels and their branchings which supply the bone structure of the epiphysis, and (2) on the diaphyseal side of the free and extensive anastomoses of the numerous terminal loops (Fig. 3) of

Fig. 1.

Fig. 2.

Fig. 1. Injection specimen of the vascular structure of a long bone. Note the nutrient artery and arrangement of the branches (A), epiphyseal circulation (B) relative avascular area (C). (After E. Lexer, Kuliga and Turck.)

Fig. 2. Longitudinal section through growing end of a long bone of a fetal pig. Low power magnification. Note centers of ossification, relative avascular areas and distinction between epiphyseal and diaphyseal circulations.

Fig. 3.

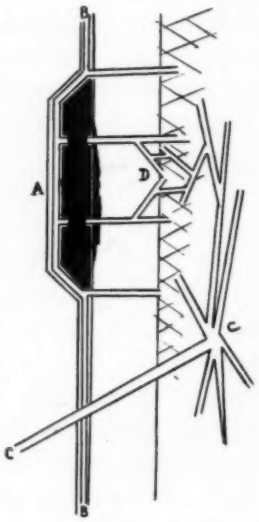

Fig. 4.

Fig. 3. Schematic drawing showing the vascular paths in the tibia of a young dog. (After Teruo Hobo.)

Fig. 4. Diagrammatic representation of the formation of a subperiosteal abscess based on a hematoma formation. BB is the periosteal circulation. CC is the nutrient artery circulation. D is the anastomatic area. If infection enter from the periosteal side of the circulation an abscess results. If infection enter from the bone side of the circulation, some disturbance of bone nutrition may follow and a slight degree of sequestration may occur. Usually, no new bone formation from periosteal activity occurs. Compare with Figure 5.

the nutrient artery of the diaphysis of the bone. Near the avascular area on the diaphyseal side of the conjugate cartilage end-vessels are also present. Nutrition in the avascular area is a lymphatic affair.

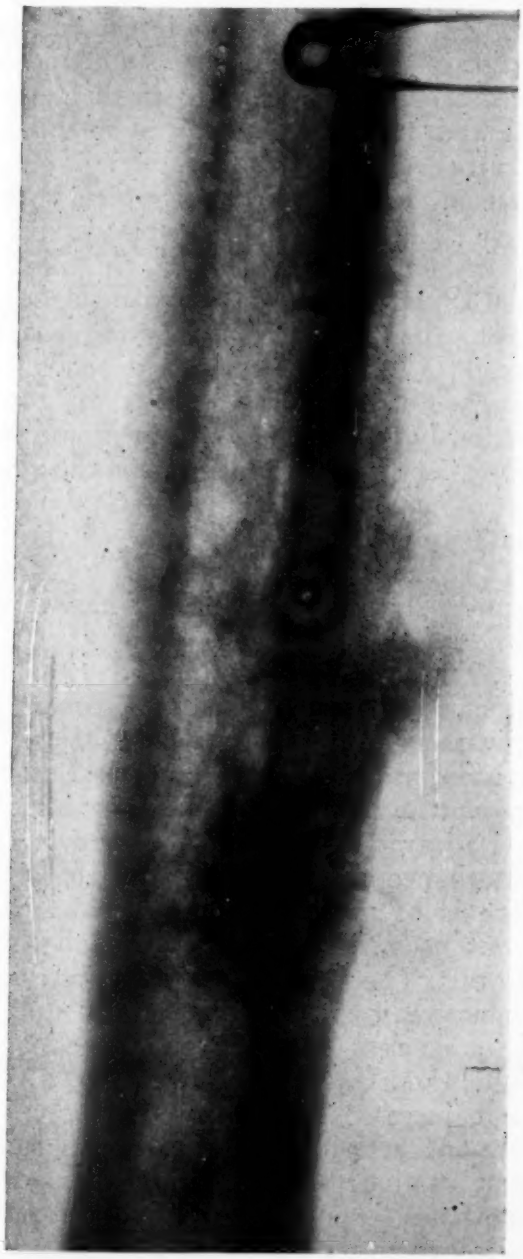

Fig. 5. Roentgenogram of an actual case illustrating the diagram in Figure 4; compare with the latter.

The various pathological pictures that result depend upon the size of the plugged vessel, the relative position of the plug, the powers of vascular anastomosis, the capabilities for development of collateral circulation, in conjunction with the character, virulence, etc., of bacteria giving rise to the infection. The following general pathological pictures form the main varieties:

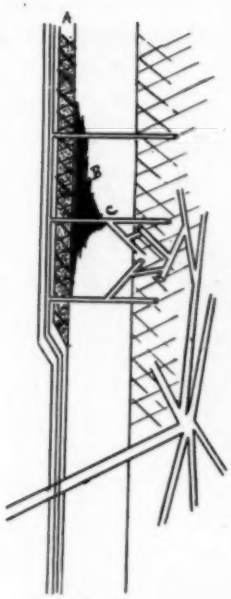

Fig. 6.

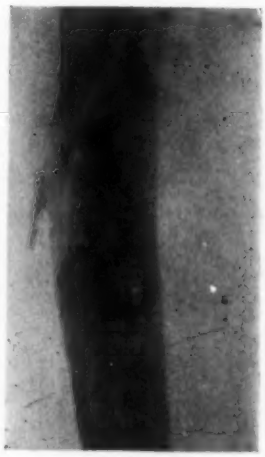

Fig. 7.

Fig. 6. Diagrammatic representation of an embolus-thrombus formation in a small cortical vessel in the mechanism of acute osteomyelitis involucrum (A), sequestrum (B), approximate position of thrombus-embolus (C). In this variety the direction of blocking of the circulation and of the entry of infection is from the nutrient artery side of the circulation. Compare with Figure 7.

Fig. 7. Roentgengram of an actual case illustrating diagram in Figure 6; compare with the latter.

1. Figures 4 and 6 show the general arrangement of the blood supply in the general area of junction between cortex and periosteum. Figure 4 shows conditions based on a hematoma formation and in which a subperiosteal abscess forms. In addition to the rupture of Sharpey's fibers and the subperiosteal hematoma infection enters and centers in one or more of the thrombosed vessels. In many cases infection is brought from the bone side of the circulation (Fig. 4, B). Depending on amount of disturbance of capillary circulation, disturbance of nutrition can occur in the cortex of the bone, and an inconsequential sequestration can occur. On the other hand, if the infection enter the clotted

area from the periosteal side of the circulation, infection centers in the clot at the relative point A, Figure 4, and a subperiosteal abscess forms; this is the variety of case in which, after proper incision of the subperiosteal abscess healing occurs without interruption and with permanency,

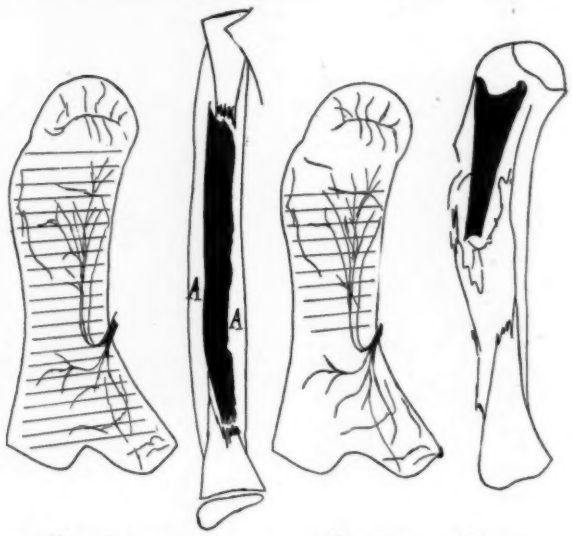

Fig. 8. Fig. 9. Fig. 10. Fig. 11.

Fig. 8. After Figure 1. Shaded area represents approximate area of bone involved when a thrombus-embolus (fixation point) occurs in the main stem of the nutrient artery. Compare Figure 9.

Fig. 9. Tracing from a roentgen-ray plate of an osteomyelitis of the radius. The black area represents the sequestrated diaphysis. Such roentgenographic appearances indicate a fixation point in the main stem of the nutrient artery. Compare Figure 8, involucrum.

Fig. 10. After Figure 1. Shaded area represents approximate area of bone involved when fixation point occurs in one of the primary divisions of the nutrient artery. Compare Figure 11.

Fig. 11. A tracing from a roentgen-ray photograph of a case of osteomyelitis of the humerus. The black area represents the sequestrum. Note that the lesion extends through the entire thickness of the shaft and from approximately the point of entry of the nutrient artery to the extremity of the shaft. The roentgenographic appearances are those of a lesion in the primary division of the nutrient artery. Compare Figure 10.

and without involvement of the bone cortex and consequently without any sequestration of bone. There is never any roentgenological evidence of this type of subperiosteal abscess.

Subperiosteal abscesses produced by a similar mechanism occur also as manifestations of a metastatic deposit in the course of a general infection as previously defined, and in the absence of any trauma. Figure 5 shows an actual case which corresponds to this condition.

2. Figure 6 represents conditions where the embolus-thrombus formation occurs in one of the small vessels in the cortical portion of a part of the bone. An abundant collateral circulation from both the periosteal and nutrient artery systems limits disturbance of nutrition to a minimum. Resulting sequestration corresponds with extent of disturbance of the blood supply. Involucrum formation from the periosteum is not as abundant as with the other types owing to lesser intensity and smaller spread of the process and depends for existence upon causes similar to those previously described. Various grades of this variety exist depending upon the number of small vessels involved primarily and upon the possible spread of thrombosis in the neighboring vascular network. Figure 7 shows an actual case which corresponds to this condition.

3. Figure 8 represents conditions when an embolus-thrombus formation occurs in the main nutrient vessel of a bone before its division into its primary branches. Secondary clotting is widespread throughout the entire intraosseous vascular network. The disturbance of blood supply for the given bone is of maximum degree and subsequent necrosis of the entire diaphysis is the rule. The formation of the subsequent protective involucrum is entirely due to the scatheless condition of the periosteal circulation. Under the influence of a very great increase in the blood supply the dormant activity of the periosteal osteoblast receives a powerful stimulus, new true bone tissue is formed and surrounds the sequestrated shaft and an involucrum is thus formed. Figure 9 is drawn from an actual case corresponding to this condition.

4. Figure 10 represents conditions when an embolus-thrombus formation occurs in the course of one of the primary branches of the nutrient artery, close to the point of division. The disturbance of nutrition

depends upon the degree of intraosseous clotting and upon the capabilities of the collateral circulation. The segment of bone tissue destroyed corresponds closely with these conditions and involves the entire cross section of the bone. Involucrum formations follow also along similar lines and depend upon factors and processes outlined in the previous paragraph. In clinical surgery specimens are encountered in which a sequestrum removed at a subsequent operation represents the entire circumference of the bone. Figure 11 is from an actual case corresponding to this condition.

5. Figure 12 represents conditions when an embolus-thrombus formation occurs in the course of one of the subsidiary branches of the nutrient artery, close to the point of division. The disturbance of nutrition depends upon the extent of intraosseous clotting and upon the capabilities of the collateral circulation. The segment of bone tissue destroyed corresponds closely with these conditions. Involucrum formations follow also along similar lines and depend upon factors and processes outlined in the previous paragraph. In clinical surgery specimens are quite common in which a sequestrum removed at a subsequent operation represents a portion of the circumference of the bone. Figure 13 is of an actual case corresponding to this condition.

6. Figure 14 represents conditions when an embolus is arrested in a terminal branch of the intraosseous network. This variety represents the mechanism of formation of a chronic bone abscess. The arrested embolus is or becomes infected and an abscess forms around it. There can be no further spread of the process through the vascular channels of the bone because the plugged vessel is a terminal one. The spread of the abscess locally is comparatively small and is quickly limited as soon as hard bone is reached. Progress through the hard bone is very difficult and in a certain proportion only is the eroding process sufficient to open an avenue into the soft parts. In clinical surgery the evidences of this are found in an acute or chronic osteomyelitis with or without one or more skin sinuses in which the complicated sinus leads at one point into the interior of the bone into a cavity containing pus or granulation tissue or both. In the rest of the cases the abscess formed originally becomes localized and becomes bounded by a firm granulation member and by the hard cortex of the bone. After a while the organisms in the interior of the abscess die and a sterile collection of pus results. In clinical surgery these form the chronic bone abscesses (Brodie) and, depending on the relative time at which the abscess is opened, one may find a chronic bone abscess containing living organisms or one which is bacteriologically sterile.

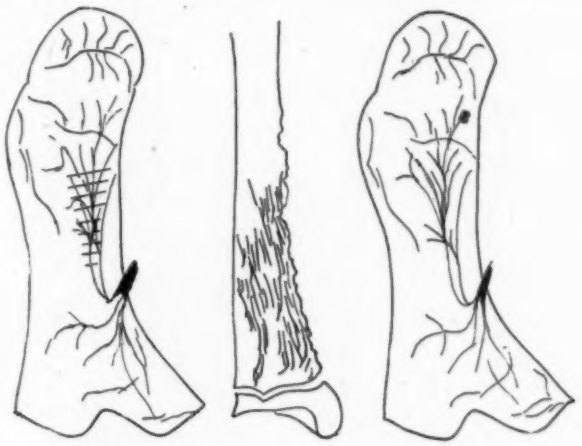

Fig. 12. Fig. 13. Fig. 14.

Fig. 12. After Figure 1. Shaded area represents approximate area of bone involved when the fixation point lies in a subsidiary branch of the nutrient artery. Compare Figure 13.

Fig. 13. A tracing from the roentgen-ray photograph of a case of osteomyelitis of the tibia. The area of bone involved does not extend through the entire thickness of the shaft and lies to one side of the point of entry of the nutrient artery and the diaphyseal cartilage. Compare Figure 12. The fixation point is in a subsidiary branch of the nutrient artery.

Fig. 14. After Figure 1. Shaded area represents localized area of bone involvement when the fixation point is in a terminal vessel. The result is a bone abscess. Compare Figure 15.

7. Figure 15 represents a group of cases of acute osteomyelitis in which one or more fixation points, either simultaneously or subsequently to one another, are

formed within the confines of a single bone, at each of which a typical thrombophlebitic lesion develops independently of the others. In the early stages of such a multiple pathological formation the lesions are distinct from one another and the roentgenographic appearances follow along lines described in the previous five typical groupings. No further progression may occur. In many of the cases, however, the consequences of the initial thrombophlebitic lesion involve such an extensive part of the bone, that the several foci overlap one another immediately or coalesce subsequently at their peripheries so that a fusion occurs of more than one lesion; a large atypical area of bone thus becomes involved. In such cases individual foci lose their identity in the roentgenographic pictures and their nature can only be surmised.

8. In a small percentage of the cases of acute osteomyelitis, the focus of infection not only involves the ramifications derived from the nutrient artery, but the periosteal network as well. Usually these are severe forms of infection and result in a total destruction of osteoblastic cells whether situated under the periosteum or in the endosteum. The end-result is a loss of continuity in the given bone. Figure 16 is an example of this type of osteomyelitis.

In a fairly large proportion of the cases of acute osteomyelitis, this classification simultaneously represents a classification of the end-results of this disease, as far as changes in substance, structure and form of the bone are concerned (when the contour of the bone is not mutilated in the operative manipulations that accompany an osteotomy as hereinafter described), with the exception that following the casting off of the sequestra the subsequent healing of the wound would necessarily be accompanied by the formation, in greater or lesser degree of a protective

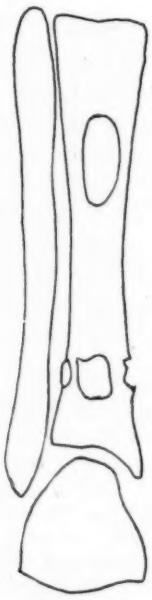

FIG. 15.

FIG. 16.

FIG. 15. Tracing of roentgenogram of a case of osteomyelitis of the tibia in which there are multiple localizations of the process. Note this is entirely different from the usual roentgenographic markings which accompany separation of a considerable part of the diaphysis.

FIG. 16. Roentgen-ray photograph of terminal condition in case of osteomyelitis of the ulna. The irregular masses of bone are involucrum formations. Note absence of bone tissue in the center. This indicates compromising of the periosteal as well as nutrient artery circulations, the former preventing any involucrum formation.

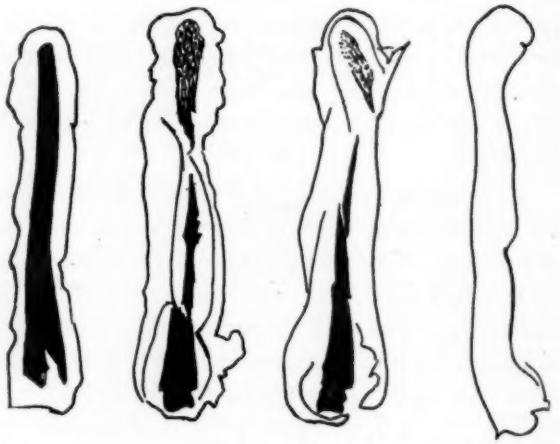

FIG. 17. FIG. 18. FIG. 19. FIG. 20.

FIG. 17. Tracing from roentgenogram of a case of "nutrient artery lesion" in an osteomyelitis of the radius. Figures 18, 19, and 20 give the further developments of this case. Figure 17 was taken October, 1924.

FIG. 18. The same as Figure 17, November, 1924.

FIG. 19. Same as Figures 17 and 18, December, 1924.

FIG. 20. The same as Figures 17, 18, and 19, February, 1925; shows one view of the end-result.

involucrum. The character and general tendencies for the formation of the involucrum under these undisturbed conditions is best shown in all of the accompanying figures, the legends of which carry a full description of the essential steps in the course of events. Such end-results are fairly frequently seen in clinical surgery and can be demonstrated in the roentgenographic evidence and in operating-room observations. Figures 17 to 20 demonstrate the complete biological development of a case of osteomyelitis in which a nutrient artery lesion occurred in the radius of a child.

Appreciation of the statements made in the last paragraph is most important for a correct understanding of the pathological process and of its effects and for the formation of criteria upon which to formulate correct methods of surgical treatment and of operative manipulation. Whatever other changes and modifications of these underlying and essential anatomical and pathological facts and conditions are encountered in clinical, bedside and operating-room observations are directly due (1) to the spreading characteristics of a thrombophlebitic lesion in osseous tissue; (2) to the mutilations of the bone that necessarily accompany any osteotomy; (3) to combinations of both of these complicating factors; and (4) to exacerbations of infection of endogenous or exogenous origin. A correct appreciation of the effects of the these complicating factors is of paramount importance in understanding of pathogenesis of complicated foci of osteomyelitis. Progressive and retrograde spreads of the thrombosis occur and explain certain otherwise inexplicable clinical facts associated with exacerbation and recrudescence or sudden unexpected enlargement of the area of bone involved in individual foci of osteomyelitis. Such effects are particularly apt to occur after operation. Roentgenograms sometimes show a spreading of the thrombophlebitic lesion which undoubtedly is intimately related to the osteotomy.

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Discussion

Dr. Henry Milch: Dr. Wilensky has brought out the idea that the fundamental factor in the development of osteomyelitis is the site of lodgment of an infected thrombus. For as long as I have had occasion to think about this problem, I have felt that the relationship between osteomyelitis and vascular supply, first suggested by Lexer and subsequently by others, must be causal in nature. However, it has seemed to me that in addition to this, there must be other factors operating. If this were not the case then we should expect that every fracture, where displacement has occurred and complete interference with the vascular supply must be predicated, would show sequestration. Except in fractures of the neck of the femur, we find only few cases out of thousands of fractures where interference with blood supply can be held accountable for the bone changes that occur. On the contrary, in the seriously comminuted fractures, where there is extensive destruction of blood supply, we find the best tendencies toward large callus formation. While significance of the blood supply in any inflammatory process will be admitted, I believe that this mechanistic explanation of osteomyelitis is somewhat too simple. I think we must admit and seriously look for other factors in the explanation of the development of the various forms of osteomyelitis.

Dr. Philip J. Lipsett: The theory advanced by Dr. Wilensky was first propounded by Lexer, Kuliga, Turck and others. According to this "mechanistic" view, acute hemotogenous osteomyelitis is merely an accidental occurrence and location of the lesion in the bone depends only upon size of the embolus. The larger the embolus the larger is the vessel plugged, and the greater is the amount of bone involved. According to this theory, the main nutrient artery may become plugged by an embolus as shown in some of the plates

this evening, thus compromising the entire shaft.

This theory does not explain all the facts in the pathogenesis of acute hematogenous osteomyelitis for it fails to answer why this disease occurs almost only in the young between the ages of two and seventeen years; it does not explain why this disease does not occur after complete ossification has taken place; it does not explain how some of these large septic emboli, and they must be large to plug up a large vessel, pass through the pulmonary circulation. Starr, Bancroft and others have observed beginning of the lesion in the metaphysis only. I have had the opportunity to see this disease develop under my observation and I am only sorry that time does not permit me to show slides of two very interesting cases. One patient with acute gangrenous appendicitis developed tenderness over the lower end of the right tibia with a temperature of 103° F. the second day after the operation. An osteomyelitis was suspected and as soon as a swelling appeared (a subperiosteal abscess) it was incised. Daily roentgen-ray examinations show very prettily the development of the focus in the metaphysis. Another patient with peritonsillar abscess developed pain and swelling over the head of the fibula.

I have the plates of this case showing the development of the osteomyelitis process from a minute focus at the metaphysis to a stage where half the shaft became involved. Hobo's experiments with particles of India ink show definitely that when the latter are injected into the circulation they will be caught at the metaphysis where the reticulo-endothelial system is particularly rich, and where circulation is rather sluggish.

It is more reasonable to suppose that bacterial emboli (temporary bacteremias) will be caught in the zone of growth or metaphysis of the young bone and for some still unexplained reason will establish an osteomyelitis. The pus from this focus will ascend in the medullary cavity as well as burrow along the epiphysis, strip the periosteum and thus devitalize a certain segment of bone. How much bone will eventually become necrotic will depend entirely upon virulence of the organism and how early drainage is instituted. That no one theory explains the pathogenesis is obvious. Perhaps a number of factors operate to produce this disease.

Dr. Frederic W. Bancroft: Ritter propounded the theory which Dr. Wilensky has emphasized that the necrosis in acute osteomyelitis is due to emboli in the nutrient artery. While unquestionably emboli do frequently occur at the origin of the entire nutrient artery, it seems to me more logical to assume the emboli first start in the small terminal branches of the nutrient artery and that necrosis is produced by the retrograde thrombosis. I assume this, first, because in almost every case there is a primary onset of pain and tenderness localized over one metaphysis, second, because early cases operated upon rarely show marked necrosis, while those appearing late after the onset have a massive sequestration, often of the entire shaft.

We may assume following the formation of emboli of the terminal branches of the nutrient artery infection travels, first, by direct extension through the Haversian canals of the metaphysis to form a subperiosteal abscess and, second, by retrograde thrombosis and periphlebitis following the course of the nutrient artery.

I believe that the necrosis of the bone is usually due to a circulatory interference as it follows the anatomical distribution of the nutrient artery.

Dr. Wilensky (closing): I did not refer to the literature, although I am fully cognizant of all the work referred to this evening, in order to conserve the time of my presentation. In view of the modern conceptions of acute hematogenous osteomyelitis, I believe that Lexer's work on osteomyelitis and bone necrosis should be thrown out. The anatomical work of Lexer, Kuliga and Turck is good inasmuch as it gives us the anatomical basis for this disease. Hobo's work is also anatomical. Ritter's work is good; he seems to have had the idea that there was a thrombo-embolic process and he appreciated the importance of the latter in acute osteomyelitis, but he never worked the mechanistic theory out fully along anatomical lines.

I believe that the lesion starts somewhere in the vascular network of the bone, somewhere along the nutrient artery network, in the periosteal network, or in the epiphyseal network. I have no quarrel with Dr. Bancroft's belief that the process starts in the metaphysis; but I believe he is restricting himself unduly and that this is only a part of the large

conception of the disease. One of the last pictures demonstrated apparently such an involvement and I showed it purposefully; but as one follows the later pictures one sees that the process eventually involved the entire shaft. Two explanations are available: (1) that the process extended backwards in a retrograde thrombosis; or (2) that the roentgen-ray picture shows only that part of the process in which bone absorption has taken place. Visualization of periosteal changes along the entire extent of the shaft and that, too, of about the same age in its entirety inclines me to think that nutrient artery blockage has taken place. Either of these explanations, however, is entirely satisfactory according to our mechanistic conception.

Dr. Milch brought up the question why one does not see sequestration commonly after fractures. As a matter of fact it is quite commonly seen in fractures of the neck of the femur. And Dr. Jaches has told me of a case of a fracture of the shaft of the femur in which such a necrosis followed along anatomical lines. In several personal cases of fracture of the olecranon process of the ulna I have also seen this subsequent necrosis along anatomical lines. Dr. Milch should remember that in acute osteomyelitis one is dealing not only with anatomical things but also with superimposed infections. And simple explanations are usually right.

I have seen a number of Dr. Lipsett's roentgen-ray pictures on other occasions. And all of them seem to fall into line perfectly with my conception of acute osteomyelitis. The reason why this disease is so much more frequent in children is associated with the presence of the conjugal cartilage and with consequent peculiarities of vascular arrangements which lend themselves more peculiarly than in adults to the localization of thrombus-emboli in the bone vascular network. However, acute osteomyelitis does occur in adults.

A MODIFIED BALFOUR RETRACTOR

H. DAWSON FURNISS, M.D., F.A.C.S.

NEW YORK

THE difficulties I have encountered when using the regular Balfour retractor have been the spreading of the groove in the blade handle, wearing of the threads of the holding screw, catching of dressings and ligatures on this screw,

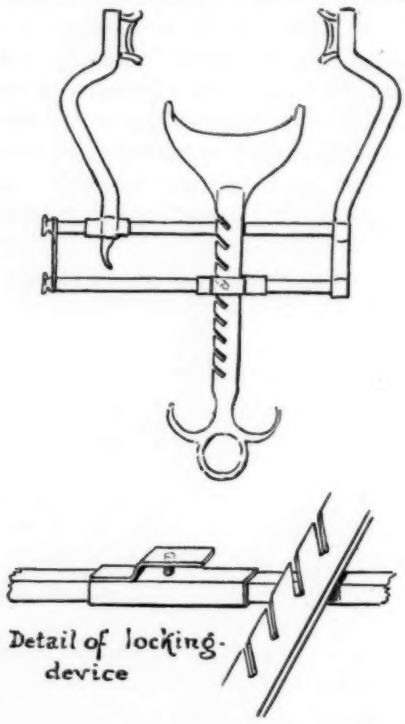

FIG. 1.

and trouble in adjusting the blade when it was not easy to enter the holding screw through dilated portions of the blade handle.

All of these difficulties I have overcome in my modification of the Balfour retractor. In this modification the blade handle is notched on one side, at three-sixteenth inch intervals, by slots that run backwards at an angle of forty-five degrees; these slots are three-sixteenth of an inch in breadth, and deep enough to reach the centre of the handle.

There is a hollow square one and one-half inches long, which moves loosely on one of the transverse bars of the retractor. On top of this is a pin slightly smaller than the slots in the handle and a bit longer than the thickness of the handle. The top of this pin is attached to a piece of metal the length of the hollow square.

In use the lateral blades are inserted and adjusted for transverse distention of the wound. The third blade is then inserted and drawn tight enough to secure the desired exposure. The slot is then slipped over the pin, the tension of the wound obviating any slippage.

The retractor is easily placed and adjusted, and remains securely in the desired position.

PRESENTATION OF CASES

LUNG ABSCESS

PERCY KLINGENSTEIN, M.D.

L. M., aged seventy-one years, entered Mount Sinai Hospital, service of Dr. Beer, in September, 1925, with a history of two weeks' pain in the angle of the jaw. Family, personal and previous history were irrelevant. Present illness dated back two weeks when patient began to cough and complained of pain at the left side of the mandible. Pain was aggravated by coughing and swallowing, and accompanied by some pyrexia and one chill. There was some expectoration, not fetid. The day before admission patient noted a swelling in the neck. Surgical status: Elderly man, appearing acutely ill, presenting a diffuse swelling in the anterior portion of the neck, extending from the suprasternal notch to the thyroid cartilage, which was felt to be displaced to the right. Over the left side of the neck, particularly anteriorly, there was a large tender edematous swelling in which deep fluctuation could be elicited. Aspiration yielded malodorous pus. Tempera-

ture 103.6°F. Preoperative diagnosis: Acute thyroiditis or mediastinitis, presenting in the suprasternal notch, possibly secondary to an esophageal perforation.

Under local anesthesia a large abscess located beneath the prethyroid muscles, containing about six ounces of pus, was evacuated and drained. The abscess extended downwards beneath the sternum and along the trachea, but further exploration was desisted from on account of the possible danger of breaking down adhesions or spreading infection along the cellular planes of the mediastinum, if this condition had not already existed. Pus from the abscess cavity contained on smear Gram-positive cocci in chains and Gram-negative bacilli which on culture yielded a Morgan bacillus (colon group).

The first roentgen-ray pictures showed what was suspected clinically: (1) a marked widening of the superior mediastinum in the region of the thyroid; (2) trachea displaced to the right and (3) a circular shadow 1½ in. in diameter in the lower portion of the left upper lobe which was unsuspected. Second roentgen-ray films six days later revealed the same shadow situated at the level of the fourth rib anteriorly and interpreted as an abscess. There were never any physical signs to make one suspicious of a pulmonary lesion. Aside from a slight unproductive cough, the patient had no symptoms accountable for the roentgen-ray finding. He was discharged to be observed.

About one week later he was readmitted with fever, cough, fetid expectoration hemoptysis, and high, remittent temperature. Chest signs were minimum. A roentgenogram showed a marked increase in size of the previously noted shadow which now extended from second to fifth rib anteriorly. There was also noted a fluid level. Accordingly, under local anesthesia, a resection of the fourth rib in the mid-axillary line was done. The pleura was entirely sealed off and a small rim of lung tissue was found to overlie an abscess cavity about the size of an orange containing foul pus. This cavity was lined with gangrenous pulmonary tissue. On straining, air could be seen to issue from numerous small bronchial openings. Drainage was established by rubber dam. The temperature came down to normal almost immediately; the pulse rate subsided gradually; the wound granulated well; the small bronchial opening closed gradually; and the patient was discharged four weeks after operation with a granulating wound, which later closed completely.

Since that time he has been practically symptom-free. The wound has remained healed except during the period of an upper respiratory infection when the incision reopened and evidences of a bronchial fistula were present. The case is presented in an effort to obtain an opinion as to the sequence of events in this case. Did the pulmonary suppuration antedate the mediastinal infection or vice versa and what was their causal relationship?

(No discussion)

FAT NECROSIS OF THE BREAST

PERCY KLINGENSTEIN, M.D.

B. J., female, aged thirty-eight years, was admitted to Mount Sinai Hospital, service of Dr. Berg, with a history that five weeks previously she first noted a lump in her right breast, unaccompanied by pain or discharge from the nipple. There was never any history of trauma. No increase in its size was noted. Both breasts were pendulous. Just above the areola of the right breast there could be palpated an irregular, finely nodular, firm, diffuse plum-sized mass, rather superficial but still appearing to take origin from breast tissue. It was adherent neither to the skin nor to the underlying structures. There was no nipple retraction or enlarged axillary gland. The mass was not easily definable but seemed rather to merge intimately with normal breast tissue. Preoperative diagnosis—carcinoma (?). Operation: Under general anesthesia a two-inch radial incision was made over the tumor mass, which was completely excised. Section showed it to consist of inflamed and necrotic masses of fatty tissue. Microscopical examination showed a typical fat necrosis.

I present this case not so much for its own interest, because both clinical and pathological aspects of fat necrosis of the breast have been adequately established by Lee and Adair, but rather in connection with the next case which presents another form of fat necrosis of important clinical significance.

(No discussion)

PSEUDO-RECURRENCE AFTER RADICAL AMPUTATION OF BREAST FOR CARCINOMA

PERCY KLINGENSTEIN, M.D.

J. M., aged forty-seven years, entered the surgical service of Dr. Berg, Mount Sinai

Hospital, for a carcinoma of the left breast for which a radical mastectomy was done. Four months later she reentered the hospital because in the axillary portion of the wound just below the scar there was a rather hard nodule, partially adherent to the skin, about the size of a five-cent piece. It gave the impression of fluctuation and was not quite as characteristically hard as a recurrent carcinoma nodule. Impression: Pseudo-recurrence following radical mastectomy for carcinoma. Operation: Under local anesthesia a number of small intercommunicating cysts situated in the subcutaneous tissues and containing fluid of an oily consistency, were excised together with an elliptical skin area. Microscopical examination showed inflamed fatty subcutaneous tissue with cyst formation. The picture akin to, if not actually that of, fat necrosis, was produced, we believe, by operative trauma. We have now collected a series of these cases, four of which were published by Dr. A. V. Moschcowitz[1] and called by him "Pseudo-Recurrence," and Dr. Zemansky[2] has included one in a recent article dealing with this subject. Just what element unabsorbed ligature material plays in the production of this pathological state is difficult to determine. In one section an unabsorbed ligature (catgut) is readily seen. It would seem as though both operative trauma and unabsorbed ligature material, might produce the lesion. Clinically these cases present difficult problems. These nodules are not quite as hard as carcinoma nodules, are tense or fluctuating and are usually quite tender. It taxes the diagnostic acumen of the surgeon to make a differential diagnosis. On the one hand, excision of a recurrent carcinoma may be fraught with the danger of spread of the disease; on the other hand, we should relieve ourselves of anxiety and the patient of an innocuous condition, should the lesion be a pseudo-recurrence.

(No discussion)

SARCOMA OF THE CALF MUSCLES IN A BOY AGED FOUR YEARS

PHILIP J. LIPSETT, M.D.

The patient, a boy aged four years, was brought to my department in the Good Samaritan Dispensary on January 3, 1927, for a painful swelling of the right calf. His previous and family history were irrelevant.

Present history: About two months before, about the middle of November 1926, he began to complain of pain in the right calf and the mother noticed the right calf getting larger. The child gradually lost his appetite, began to lose weight, grew weaker and by Christmas, unable to walk, he lay in bed. All this time complained of pain in the calf of such severity that he was unable to sleep.

The boy's physical examination was negative with the exception of the right lower extremity. The right calf was uniformly enlarged. The skin veins over the swelling were prominent. The swelling was painful, tender and tense. There was no induration. The mass was not adherent to the bones. The inguinal glands were palpable on the same side. Temperature 101°F. A tentative diagnosis was made of sarcoma or gumma of the soft tissues of the calf.

He was admitted to St. Mark's Hospital on my service for additional study.

Wassermann tests on mother and child were negative. The blood showed a moderate secondary anemia. Roentgenograms of the chest were negative. Roentgenograms of the right leg showed a uniform swelling of the soft tissues of the calf, the tibia and fibula giving normal shadows.

A final diagnosis of sarcoma of the calf muscles was made. Dr. B. T. Tilton was consulted. He concurred in the diagnosis and agreed that in view of the rapid growth of the tumor, and the palpable lymph nodes in the groin, the only therapy advisable was radiation. The child was discharged from the hospital and referred to the Radiation Therapy Department of Bellevue Hospital. The examining physician apparently disagreed with the diagnosis and the boy was admitted to the children's ward with a diagnosis of deep-seated infection of the right leg. Fortunately the attending surgeon did not agree. His diagnosis was also sarcoma. The child's leg was amputated above the knee within the next few days. The patient went into shock but rallied; and when I saw him a month later, he was markedly improved. During his stay at Bellevue, he received several injections of Coley's serum. Neither radium nor roentgen-rays were employed in this case. The glands in the groin were still palpable although one

[1] Moschcowitz, A. V., Colp, R., and Klingenstein, P. Late results after amputation of breast for carcinoma. *Ann. Surg.*, 1926, lxxxiv, 174–184.

[2] Zemansky, A. P., Jr., and Gottesman, J. Fat necrosis of heart. *Ann. Surg.*, March, 1927, lxxxv, 438–449.

could not definitely say that they were larger than before the operation.

The pathological report by Dr. D. Symonds, pathologist to Bellevue Hospital, was as follows: Tumor mass, well encapsulated, no connection with bone, but adherent to the periosteum of fibula. The tumor is soft. Microscopically, it is composed of spindle cells with some giant cells of the periosteal type.

This case presents the following interesting features:

1. It is that of a sarcoma of the soft tissues of the calf in a boy four years of age. The great majority of malignant tumors in children are of renal, ovarian or testicular origin.

2. The rapid growth of the tumor produced marked constitutional symptoms, so much so, that it was mistaken for an infection.

3. It ran the course of an infection,—general malaise, tenderness, pain and a temperature that varied between 99°F. and 101°F.

4. The question arises of proper therapy and the prognosis in these cases.

RECURRENT DISLOCATION OF THE SHOULDER TREATED BY CAPSULORRHAPHY AND TRANSPLANTATION OF THE DELTOID

(CLAIRMONT-EHRLICH OPERATION)

HENRY MILCH, M.D.

F. B., aged thirty years, was referred to me July, 1926 for treatment of a recurrent dislocation of the left shoulder. The first dislocation occurred during the winter of 1918, following a fall on the outstretched arm. This was reduced by his physician and the patient was able, in a short time, to resume his work without any impairment of function. In the winter of 1921, the patient again slipped and again suffered a dislocation which he was able to reduce himself. Since that time, he has had about one hundred dislocations of the shoulder. The effort of putting on his coat or any other action which involved abduction of the shoulder to more than 60 degrees, inevitably resulted in luxation of the head of the humerus. In other directions than abduction, the mobility of the joint was normal and there was no evidence of any arthritic changes. There was no loss of power or sensation in the arm and the only limitation to normal function was the patient's fear of dislocation. A roentgenogram of the shoulder showed signs of an old injury, probably a fracture of the glenoid fossa.

I was somewhat timorous about trusting the final result to a capsular reefing or to the "tenosuspension" originally described by Joseph and subsequently modified and reported upon by Henderson. I believed that by both of these methods, the hope of cure was being placed on a structure which in itself was subject to stretching and consequent relaxation. It was felt that it would be much more logical and physiological to oppose against the tendency toward redislocation, an actively contracting muscle wound around the neck of the humerus and acting in the nature of a sling. This principle is employed in the Clairmont-Ehrlich operation. In this operation, the posterior third of the deltoid is utilized with the idea of supplying a force which shall actively support the head of the humerus and hold it in place at the very same moment and even in the very same degree that the rest of the muscle acting through its insertion into the deltoid tubercle tends to cause abduction of the arm with consequent downward displacement of the head.

To overlook nothing that might lead to the successful outcome of the operation, it was decided to combine this procedure with the time-honored capsulorrhaphy. Through a long anterior incision, extending from the coracoid process, the capsule was exposed and, after tenotomy of the coracobrachialis, was plicated both in the horizontal and longitudinal directions. The capsule was found thickened by scar tissue but showed no sign of any rent. Through a posterior incision, extending from the acromion process to the deltoid tubercle, the posterior third of the deltoid muscle was dissected free and passed through the quadrilateral space to the anterior incision. The slack in this transplant was taken up and the end of the muscle sutured as high up on the body of the deltoid as possible. Because of the shortness of the transplant, it was impossible to attach its end to the acromion process where, ideally, it should have been inserted. The fascial and skin wounds were closed in the usual manner and the patient was dressed with the arm in adduction. Apart from a slight slough in the anterior wound, an uneventful recovery followed. At the end of four weeks, the patient was permitted gradually to abduct the arm. In the beginning, he complained of an annoying sense of tightness

under the arm, but this gradually diminished and at the end of about two months, he was able, freely and forcefully to abduct his arm to about 150 degrees. At the present time, nine months after operation, the sense of weakness and the feeling of insecurity of which the patient complained previously has completely disappeared and he is able to use his arm for all his normal activities. He has observed, however, that in wide abduction of the arm he still has a slight sense of tightness in the axilla. This, of course, is due to the sling-like action of the transplanted portion of the deltoid.

(*No discussion*)

CICATRICIAL CONTRACTURE OF AXILLA AND ELBOW FOLLOWING BURN. TREATED BY PLASTIC REPAIR OF THE ELBOW WITH RECONSTRUCTION OF THE AXILLA

HENRY MILCH, M.D.

V. L. colored, aged eleven years, was admitted to the Hospital for Bone and Joint Diseases, July 12, 1926, with history of having suffered a severe third degree burn of the right side of the body in October, 1924. The burned area included the right chest wall and abdomen down to the level of the umbilicus and the inner side of the right arm as far down as the wrist. The axilla in particular was badly burned. The wounds were treated by a physician in South Carolina by application of wet dressings. The arm was, unfortunately, bandaged to the side with the elbow in 90 degree flexion so that at the expiration of the treatment, the elbow could not be extended and the arm was firmly adherent to the chest wall midway to the umbilicus. The axilla was, of course, completely obliterated.

In February, 1925, several attempts were made at one of this city's hospitals to release both shoulder and elbow. These efforts were not very successful and the patient was admitted to the hospital in the condition shown in Fig. 1. The elbow could be flexed but could not be extended beyond 90°. There was only about 45° of abduction at the shoulder, motion being markedly restricted by a firm web of scar tissue which obliterated the axilla and bound the arm down to the chest wall over more than one-third of its length.

Because of the severity of the operative procedures to be undertaken, it was decided to divide these into two stages. In the first operation performed on July 15, a large anterior skin flap with its base on the chest wall and its free edge along the anterior surface of the arm, and another similar flap with its base on the posterior surface of the arm and its free edge on the posterior chest wall, were outlined and raised. The scar tissue in the axilla was completely dissected away, permitting wide abduction. The anterior flap was turned behind and sutured to the chest wall into the area left free by the raising of the posterior flap. The posterior flap was turned anteriorly around the humerus. The flaps were sutured together along their free upper margins high in the axilla, thus forming a new axillary pit. The defect remaining on the posterior wall was obliterated by undermining and shifting a large skin flap from the vertebral region. The arm was put up in wide abduction in a plaster cast. At the end of two weeks, the sutures were removed and several necrotic areas in the angles were excised. These were later covered by pinch grafts and Thiersch grafts. At the end of four weeks, the patient was able actively to abduct the shoulder to about 120 degrees, and by exercise this was gradually increased to about 160 degrees.

On September 16, 1926, the scar in the elbow region was resected, by means of a long Z-shaped incision for the better mobilization of the skin flaps. Because of the wide resection of skin, there was some difficulty in approximating the edges even after extensive undermining and the making of counter-incisions. A posterior molded splint was applied for the purpose of maintaining extension. This, however, proved not feasible and the patient was allowed out of bed with five pounds of traction weights to overcome the contracture of the biceps and the brachialis anticus. When traction was removed, the wounds were almost healed and the child was able to abduct the arm to about 160 degrees and to extend the elbow to about 150 degrees (Fig. 2). At this time, he was sent to the physiotherapeutic department for such exercises as chinning and weight-carrying, designed to increase the range of motion both at the elbow and the shoulder. Shortly after this, he disappeared from our clinic, but I have since heard from him at his home in Carolina, that he has made a complete recovery.

The problems to be solved in the restoration of these two scarred areas are of interest

because they may be looked upon as illustrating the fundamental principles of two different types of skin plastics. In the treatment of the shoulder reconstruction, the problem appeared to be similar to that presented by web finger. In each, the problem consists in the dissevering of members normally separate which are found adherent in a parallel position. The treatment undertaken consequently consisted in the application of the two-flap operation suggested by Didot for the cure of

Fig. 1.

web finger. This operative principle can be employed in all cases, whether in mucous membrane or in skin, where the parts lying in parallel position are held together by a scar tissue bridge covered on both sides by broad areas of skin or mucous membrane.

In the treatment of the elbow, as indeed in other similar contractures, as for example those about the neck, the knee, etc., the problem consists essentially in providing skin in a longitudinal direction which has been obtained at the expense of the excess of lateral skin. For this purpose, the making of a Z-shaped incision is ideal. In the treatment of flexion contractures of the fingers, Morestin advocated what in essence is the making of a series of Z-shaped incisions continuous with one another. In a contracture as extensive as the one which we had here to treat, the simple, single Z-shaped incision with excision of the scar proved somewhat inadequate as it left the tissue under great tension. In thinking about this case subsequently, it occurred to me that an incision which would in outline represent either the line made by a continuous mattress suture or better still an incision line represented by the sine curve, might possibly have given better results and left the tissue under much less tension.

(*No Discussion*)

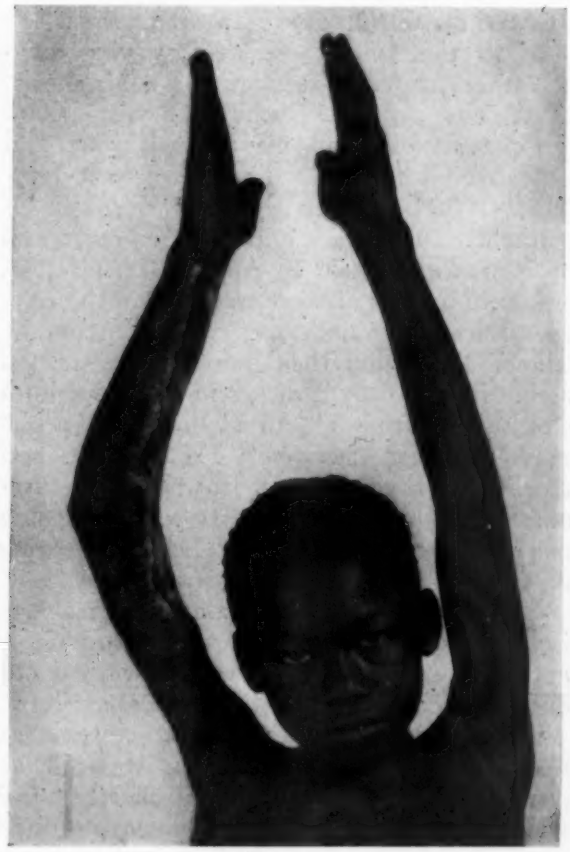

Fig. 2.

I. EXTENSIVE SQUAMOUS-CELL EPITHELIOMA OF THE HAND OF FIVE YEARS' DURATION. EXTENSIVE SQUAMOUS-CELL EPITHELIOMA OF LIP. LARGE MALIGNANT TUMOR OF CHEEK OF THREE YEARS' DURATION

GEORGE A. WYETH, M.D.

Case 1. W. McL., male, aged fifty-eight years, when a boy of eleven had dropped a little hot tar on his left hand near the base of the thumb. The result was a severe burn which in time became ulcerated and spread until it was as large as a twenty-five cent piece. For

more than two and one-half years this persisted despite the use of various ointments. Then its character changed and it became a mass of small seed-like growths. These spread across the hand to the little finger, and on the upper arm appeared deep-seated boils which resisted many months treatment, finally clearing up to leave deep scars. Again when the patient was twenty-two years old, the entire arm became inflamed on all surfaces, only the palm of the hand being relatively free from the eruption. Finally the ring finger became so enlarged it was necessary to amputate it.

In all this time there were varying diagnoses: erysipelas, elephantiasis, tuberculosis, warts, and syphilis. About four years before the patient came to me a small wart had appeared on the index finger, where it grew rapidly. In September, 1920, a diagnosis of epithelioma was made and roentgen-ray treatment was instituted. In April, 1921, after an enforced absence of some weeks from the city, the patient came under my care at Vanderbilt Clinic. The lesion then measured about 3½ inches in length by 2 inches in width, with an elevation of from 1¼ to 1½ inches. Wassermann reaction negative. The patient had repeatedly been advised to have his arm amputated at the shoulder. It was decided to employ bipolar endothermy before resorting to the extreme measure of amputation.

Under anesthesia the malignant area was isolated from the surrounding healthy tissue and the lesion was coagulated in situ, cut out and curetted down to a healthy base.

On January 17, 1927, patient states that about three months ago while at work he struck his elbow on a door, shortly after which it broke down and has been ulcerated ever since. Directly over the elbow is an open lesion 5 cm. by 2 cm. with elevated pearly edges. It was treated with bipolar endothermy January 22, 1927 and is healing nicely.

Pathologist report: Squamous-cell epithelioma (grade 3).

Case II. M. W., male, aged fifty-two years, had an extensive squamous-cell epithelioma of the lower lip (grade 2). About a year ago he noted a pimple on the lower lip, which broke down and began to spread. This increased in size despite various treatments. Patient stated that within the preceding two weeks it had increased rapidly and he was "going down hill."

The lesion involved the whole lower lip, down to the sulcus in the chin. It was a crater-like epitheliomatous growth which had already perforated, saliva going through the opening. On the left side one submaxillary nodule was rather markedly enlarged and somewhat fixed. On the right side there were three submaxillary enlargements, but all freely movable.

The patient was operated upon October 30, 1925 under anesthesia. The entire lesion was surrounded and destroyed by bipolar endothermy, and excised with the endotherm knife.

The lower lip filled in quickly except for a granulating area on the mucous membrane about 3 by 2 cm. below the teeth. Nodules on the right side of the neck and the submaxillary gland on the left side were completely reduced. The patient was given roentgen-ray treatment to both sides of the neck and referred to Dr. J. Eastman Sheehan for a plastic operation.

Two weeks after plastic operation, March 12, 1926, the patient had marked recurrence in all lines of the scalpel's incision, particularly at the angle of mouth. Again treated by bipolar endothermy March 26, 1926. No evidence of recurrence since.

Case III. A. G., a Pole, aged fifty-eight years, was admitted to the Third Surgical Division of Bellevue Hospital, March 4, 1924. At the request of Dr. George D. Stewart I removed the growth by endothermy on March 13.

According to the patient's report, the growth had begun some three years before as a sore inside the cheek, opposite the right bicuspid. It remained small for a year and then began to grow. During the six months preceding her arrival at Bellevue it had grown very rapidly and at the time I saw her the mass was the size of a large orange. There was no pain or tenderness but at intervals the tissue would bleed and parts of it would fall away. It involved the right cheek and upper lip, mainly to the right of the midline. The skin was tense and shiny and there were three spots of ulceration. Dilated veins were seen at the upper and lateral aspects of the mass. Externally the growth extended from 4 cm. anterior to the angle of the mandible on the right side around to the point opposite to the first incisor tooth on the left side. Interiorly it extended from the last molar to the midline and there was seen a deep crater-form ulceration which extended to the upper lip. The mass was lobulated and tense. Freely movable, it raised

the right ala of the nostril and seemed to involve the tissues of the upper lip and cheek only. There were a few palpable lymph glands on both sides of the neck, more on the right.

Under ether narcosis, the growth was isolated from the surrounding healthy tissue by a path of coagulation necrosis, at its base only, by the technique of bipolar endothermy. Lymphatics, blood vessels and sensory nerves having been thus seared off, the endotherm knife was brought into use. This quickly excised the tumor without hemorrhage. Convalescence was rapid, there being, as usual, no secondary reaction and no evidence of surgical shock. The patient was able to take food well, the wound sloughed without interference and granulation and filling in of the excised tissue took place. The wound healed in four weeks. One month later plastic operation was performed by Dr. Arthur M. Wright.

Dr. Symmers' report: The histology is slightly suggestive of adamantinoma and were the tumor located in the bone I should have no hesitancy in making a positive diagnosis of adamantinoma. The fact that the tumor was removed from the soft tissue in the vicinity of the lip, however, renders this diagnosis highly problematical, although one cannot entirely overlook the possibility of an adamantinoma of the soft tissues springing from congenitally misplaced enameloblasts. It is possible that the tumor represents a metastatic growth which has so changed its morphology as to resemble an adamantinoma.

The diagnosis of spindle-cell sarcoma must also be taken into consideration, although close inspection of the cells leaves the impression that they are epithelial and that the tumor belongs in the group of epitheliomata. There are so many possibilities to be taken into consideration that a positive diagnosis, in my opinion at least, is not justified.

(No discussion)

EDITORIALS

GAUZE VS. RUBBER DRAINS IN CLEAN WOUNDS

BECAUSE wound secretions coagulate in its meshes and wound surfaces become adherent to it, many surgeons have abandoned gauze as a drainage material and employ only rubber or other smooth material instead. It must be admitted, however, that a rubber drain often unduly prolongs the escape of secretions from a wound which might well have healed per primam if closed without any drainage; and often, too, the drain is thus contributory to a wound infection which it was designed to prevent. Contrary to the practice of many, one of our editors employs gauze as a drain for *clean* wounds, for reasons which he gives in the following brief communication:

RUBBER DRAINS UNDESIRABLE IN CLEAN WOUNDS

The universal employment of some form of rubber as a drain, when used to transmit the contents of a hollow viscus to the surface, such as the biliary and urinary bladders, is warranted. Likewise when there is a cavity to be emptied, such as a pelvic or pleural abscess, it is desirable.

In draining recent clean wounds of secretions likely to occur after the completion of the operation, it is theoretically and practically wrong. Rubber prevents coagulation of the secretions as they pour into a fresh wound; consequently secretions continue to pour in. The coagulation of the exudate into the wound is the initial process in wound healing and this preliminary process is prevented by the rubber drain. Therefore healing is delayed. This uncoagulated exudate is an optimal culture medium, therefore infection is invited.

The old surgeons knew that it was the failure of healing to take place about the ends of ligated vessels that brought about secondary hemorrhage. Rubber likewise hinders healing and in that measure invites late hemorrhage. This is particularly important when operating on vascular tissue as in goiter operations. Therefore if secretion is likely to form in a clean wound, gauze is the proper drain. This substance encourages coagulation and so limits the secretion and furthers the progress of healing. Many do not like gauze drains because they stick to the wounds, which makes them difficult to remove. But this very adherence proves that the gauze drains promote healing.

The facts above noted can be verified by placing a pledget of gauze in one part of an animal's abdomen and a wad of rubber tissue in another. The gauze will be found covered by adhesions in a few days, while the tubber tissue will be lying loose in an exudate. Therefore, if one desires a wound to heal, drain with gauze. If one wants to prevent healing, use rubber.

ARTHUR E. HERTZLER.

A CIVIC SERVICE

In the advertising section of this issue of the JOURNAL will be found the announcement of the Post Office Department concerning a confirmed criminal who is wanted for the murder of a letter carrier. Because this man has an active rectal ailment it is believed that he will apply for treatment to physicians or hospitals, who are requested to be on the look-out for him.

BOOK REVIEWS

SOUTH AMERICA. Amplified to Include all of Latin America; The Vandyck Cruise. By Franklin H. Martin, C.M.G., D.S.M., M.D., LL.D., F.A.C.S., Director-General, Am. Coll. Surg.; Editor, *Surg., Gynec. & Obst.*; Pres. Gorgas Memorial Institute of Tropical and Preventive Medicine, Inc. Revised Ed. 8vo. Cloth. $3. Pp. 435; illus. N. Y. Fleming H. Revell Co., 1927.

Dr. Martin has placed American surgery in his debt for his years of service as an editor and an organizer.

With this fascinating volume of medical travels in Latin America he has mortgaged another continent and a half.

An ambassador of friendship and understanding, he has opened to his confrères and others an interesting invitation to visit our sister republics, or to learn through his eyes to appreciate South American contributions to our art.

This book should be a corrective of the provincial viewpoint which frequently develops in our schools. It is refreshing to learn of the great possibilities in the lands of the other hemisphere.

SURGICAL ANATOMY OF THE HUMAN BODY. By John B. Deaver, M.D., SC.D., LL.D., F.A.C.S., Surgeon-in-Chief, Lankenau Hosp., Philadelphia; Emer. Prof. of Surgery, Univ. Penn. Ed. 2. 3 vols. 8vo. Fabricoid. $36. Vol. II. Pp. 854; 195 pl. Vol. III. Pp. 763; 159 pl. Phila. P. Blakiston's Son & Co., 1927.

Surveying the first volume of the handsome second edition of this most important of Deaver's valuable treatises (the JOURNAL, August, 1926) we described its character and its arrangement. The second volume (Upper Extremities, Neck, Shoulders, Back, Lower Extremities) and the third (Joints of the Lower Extremities, Chest, Thorax, Abdomen, Perineum) are no less attractive than the first and indicate the same thorough revision, textual and pictorial. The descriptions are precise and and are well balanced from the standpoints of anatomic accuracy and surgical significance. They include considerations of various pathologic conditions (e.g., dislocations, talipes, hallux valgus) and certain operations (e.g., ligations of vessels, amputations). The illustrations, profuse and many of them new, are from original dissections.

1926 COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Ed. by M. H. Mellish, H. Burton Logie, M.D., and Charlotte E. Eigenmann, B.A. 8vo. Cloth, $13. Pp. 1329; 386 illus. Phila., W. B. Saunders Co., 1927.

Since the "collected papers" of the Mayo Clinic and those of the Mayo Foundation, each a rich literary output every year, have been combined in a single annual volume, it has been necessary to condense some of the reprinted articles and to publish others in brief abstract or even by title only. This has been done, however, only for the more theoretical or purely research papers. The 1926 publications of practical medical and surgical interest have been here reproduced in full. The papers are appropriately grouped and adequately indexed.

A TEXT-BOOK OF PATHOLOGY. By Alfred Stengel, M.D., SC.D., Prof. Med., Univ. Penn., and Herbert Fox, M.D., Prof. Compar. Pathol. Ed. 8. 8vo. Cloth $10. Pp. 1138; 552 illus.; 18 col. pls. Phila., W. B. Saunders Co., 1927.

Stengel's Pathology has been before the profession about thirty years and in this edition it therefore scarce needs review. Despite much revision its form has not been changed. The authors have striven to continue it as a textbook for students and practitioners in which essential facts of morbid anatomy and physiology and of etiology are presented in paragraphic form, conservatively, without too great detail.

DIE CHIRURGISCHE BEHANDLUNG DER GEHIRNTUMEREN. Eine klinische Studie. By Dr. Herbert Olivecrona, Privatdozent Oberarzt an der chirurgischen Universitätsklinik im Seraphimerkrankenhaus, Stockholm. In collaboration with Dr. E. Lyshelm, Chefarzt der Röntgenabteilung des Krankenhauses, Mörby, Stockholm. 8vo. Pp. 344; 228 illus. Berlin: Julius Springer, 1927.

To consider in a volume of 340 pages the diagnosis and surgical treatment of tumors of the brain is a daring effort, but the author has

given us a very readable account of his personal experiences. Dr. Olivecrona is evidently thoroughly conversant with the literature of the subject and follows, in many features, the principles of cranial surgery laid down by Cushing and the American school of neurosurgeons.

The histories of a large number of cases are given in detail with comments on each case, and with excellent illustrations of the tumors removed at operation and of the brains removed at post-mortem examination in the fatal cases.

Separate chapters are devoted to the gliomas, to the meningiomas, acoustic nerve and hypophyseal duct tumors, to the tuberculomas, the angiomas and to metastatic growths.

A special chapter on roentgen-ray diagnosis of tumors of the brain and the technique followed by Lysholm and Olivecrona, although it contains nothing new, is quite interesting, as are the author's experiences with ventriculography, ventricular estimation, and exploratory brain puncture. There were 2 fatalities after air injection into the ventricles among 14 cases in which this diagnostic procedure was used. Both patients died in coma within twenty-four hours of the air injection. There were no fatalities when the air was injected by the lumbar route.

The chapters devoted to indications for operative interference and to operative technique present no new facts but are good summaries of the subjects, with many references to the views of other writers.

The concluding chapter on operative results, —both those obtained by others and those in the author's series—is a complete statement of what has been accomplished by those who have frankly published their full results. The author is one of those who reports all of his results, not only those that have been successful. For this he deserves the fullest credit, for the development of surgery of brain tumors has been not a little hindered by incomplete reports of the results obtained.

In summary, the monograph of Olivecrona is valuable for its frank discussion of the problems and the difficulties encountered in this new branch of surgery, and for the valuable and instructive histories of many of the author's cases. The volume should be on the shelf of every neurosurgeon.—C. A. Elsberg

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

PROGRESS IN SURGERY

Selections from Recent Literature

BREBNER, I. W. Head injuries and their treatment. *J. M. A. South Africa*, June 11, 1927, i, 281.

Brebner expresses the following opinions:

1. All cases of intracranial hemorrhage should be operated upon.

2. All lacerated scalp wounds should be operated upon and the underlying skull investigated.

3. Continued high blood-pressure, especially if associated with continued high cerebrospinal fluid pressure, is a strong indication for operation.

4. Cases showing mental symptoms some time after the injury should be decompressed.

5. Very few cases of edema pure and simple require operation, and then only when associated with a high blood-pressure.

6. Extensive laceration of the brain offers very little hope of successful operative interference.

7. Dilated and fixed pupils are a definite contraindication to operation.

8. High pressure of the spinal fluid is of greater value than high blood-pressure as an indication for operation.

9. Increase in temperature is a bad omen, more especially of the rise is sudden and continues for more than forty-eight hours.

ROCKEY, E. W., Portland, Oregon. Value of radiographic contrast solutions in the study of brain abscess. *Ann. Surg.*, July, 1927, lxxxvi, 22.

A case is reported to illustrate the value of sodium iodide roentgenographs.

BUNNELL, STERLING, San Francisco. Suture of the facial nerve within the temporal bone; with a report of the first successful case. *Surg. Gynec. & Obst.*, July, 1927, xlv, 7.

Bunnell reports a case in which he performed the difficult and delicate operation of reuniting by suture within its bony canal a facial nerve that had been divided at a mastoid operation four months previously, and on the proximal end of which there had formed a neuroma that had to be removed to effect regeneration. A cure resulted—the first successful operation of the kind to be recorded. Bunnell, who has shown the feasibility and desirability of reuniting divided nerves in the hand and fingers, advises that one should not attempt this operation without practising the suture of small nerves in a piece of meat. The fine stitches are all passed through the sheath only. The exposure of the nerve must be very carefully done, of course; it lies deep below the skin and a very fine curved needle is necessary for the work within the canal. Bunnell chiselled away the vaginal process of bone at the stylomastoid foramen in order, by shortening its course, to approximate the nerve after cutting away the neuroma and a little of the distal end. This end was adherent in the canal and needed to be freed with a fine probe. The branches to the stylohyoid and posterior belly of the digastric, which were also holding it, were deliberately divided. The posterior wall of the facial canal was chiselled away to the level of the nerve to facilitate the needle work. Adrenalin and wax were used to secure a dry field.

BERGAMINI, H. and SHEPARD, L. A., New York. Bilateral atelectasis (massive collapse) of lung. *Ann. Surg.*, July, 1927, lxxxvi, 35.

Postoperative atelectasis, or massive collapse, is usually a benign, unilateral condition, occurring from a few hours to a few days after operation. The collapse may, however, be bilateral and may occur at, or immediately after operation, and cause sudden death.

The extreme rapidity of onset of such cases tends to disprove the obstructive theory of the etiology of the condition.

There was no evidence of gross obstruction of the bronchi of the collapsed lungs at necropsy.

The histological appearance of these lungs strongly suggests that the cause of the atelectasis may be a vasomotor disturbance of reflex origin, possibly identical with or closely akin to angioneurotic edema.

HARRIS, F. I., San Francisco. Non-inversion of the appendix stump. *California & West. Med.*, July, 1927, xxvii, 69.

The inversion methods of treating the appen-

dix stump are dangerous, unsurgical, and unnecessary for the following reasons:

1. There is danger of abscess formation in the wall of the cecum.

2. In the true inversion method there is danger of secondary hemorrhage from the unligated appendicular artery.

3. These methods are not applicable to every case, require more time and offer greater technical difficulties.

4. They are largely responsible for the postoperative appendectomy adhesions and probably give a greater incidence of fecal fistulae.

5. They are the cause of remote complications such as inflammatory tumors of the cecum and diverticula.

On the other hand, non-inversion offers a method to which none of these objections can be made, and in addition it is undeniably simple, time-saving, and adaptable to practically all cases.

Clifton, H. C., and Landry, B. B. Fibromata of the intestines. Report of a case and review of the literature. *Boston M. & S. J.*, July 7, 1927, cxcvii, 8.

Forty-five cases of fibromata of the intestine were found in the literature, of which forty were encountered at operation and five at autopsy. The majority were found in the small intestines.

These tumors most commonly assert themselves by bringing about intussusception. Evidence is produced to show that intussusception results from reaction of the bowel to what is virtually a foreign body. Sometimes reduction of the intussusception and enterotomy will be sufficient. This is perhaps the ideal way, but often, because of the thickening, edema and inflammation of the bowel and doubt as to its viability if replaced within the abdomen, this course cannot be followed. In one case (Bevan) an enterotomy was done and the tumor removed, following which the intussusception was reduced. Resection will be more commonly indicated. The tumors when sectioned are often inflamed and infiltrated and at times enlarged glands are found in the mesentery. In any case where there is doubt as to the benignity of the tumor or when enlarged glands are present, resection is the only rational procedure. However, bearing in mind that benign tumors of the small bowel outnumber malignant tumors more than two to one and enlarged glands being absent, it is equally rational, if the intussusception is reducible, to do a simple enterotomy and then if gross characteristics of the tumor further indicate it as benign, to excise the tumor and pedicle. Often the intussusception is irreducible and there is no recourse except to resection.

Gibson, T. E., San Francisco. Diagnosis of adrenal tumors with classification of adrenal tumor syndromes, and report of cases. *J. Urol.*, July, 1927, xviii, 33.

Adrenal tumors in general produce three distinct syndromes, (1) the genitosuprarenal, (2) the Hutchison, and (3) the Pepper.

Cortical tumors of the adrenal (carcinoma) produce characteristic changes in the sexual sphere, namely, the so-called "genitosuprarenal syndrome." These are in a word, virilism or pseudohermaphroditism in the female, and precocious puberty in the male. The changes in both sexes are toward the adult male type. Cortical tumors in the adult male, therefore, exhibit no clinical features of diagnostic importance in the sexual sphere. Benign hyperplasia and adenoma formation in the adrenal cortex may give rise to the same syndrome.

Cortical tumors may occur at any age. They appear to be as frequent in infancy as in the adult, and are more frequent in the female.

Pigmentation of the skin and mucous membranes occurs in cortical tumors in not over 3 per cent of cases. It does not occur in medullary tumors.

Hypertension appears to be a fairly constant symptom of cortical tumor, particularly in young subjects, and is therefore of some diagnostic value.

The common tumor of the adrenal medulla is the neurocytoma, or "sarcoma." It occurs almost exclusively in infancy and childhood.

Two types of neurocytomata are distinguished:

The Hutchison type is characterized by early metastasis to the orbit, usually to the side on which the primary tumor is located, producing unilateral exophthalmus, or proptosis of the eyeball. In many instances the primary tumor has remained undiscovered until autopsy.

The Pepper type of neurocytoma is characterized by rapid enlargement of the abdomen, due to metastasis to the liver. The liver reaches enormous proportions, although the primary tumor may remain small, and there are generally no other metastases.

The prognosis is malignant tumors of the adrenal is almost invariably bad, because of the

frequency with which metastatic phenomena are the first symptoms of the disease. This is true particularly of medullary tumors. Occasional cures are reported in cortical tumors. The course of adrenal malignancy is extremely rapid.

The treatment of adrenal tumors is surgical and radiological. Although usually hopeless, operative interference is indicated in the hope of finding a benign growth or cyst, or of removing a malignant tumor before metastasis has occurred. If surgery is contraindicated, deep roentgen-ray therapy deserves a trial.

Urological investigation is indicated as a preliminary to any operative procedure, not only as a diagnostic measure, but to determine relative renal function as it is very often necessary to remove a kidney with the tumor mass.

In a series of 46,265 admissions to the University of California Hospital, there have been but 4 cases of proved primary adrenal tumors. Two were cortical and 2 cases medullary in origin. Five other cases are analyzed, in 3 of which there were metastases to the adrenal from some other source, and in 2 diagnosed adrenal tumor but the diagnosis was never confirmed. Metastasis to the adrenal from tumors elsewhere in the body may produce the cortical syndrome and in some cases an Addisonian syndrome.

Smith, K., Kansas City. The clinical significance of ureteral obstruction. *Kansas City Clin. Soc. Montb. Bull.*, July, 1927, iii, 27.

Smith believes that ureteral obstruction, far from being a rare pathological curiosity, is an extremely common cause of abdominal pain. When situated near the bladder, it is productive of much bladder disturbance. It is directly responsible for urinary stasis, which together with intestinal stasis, probably of reflex nerve origin, results in toxic retention with headache, general debility, etc. In women, when situated in the broad ligament region, its correlation with the pelvic organs is productive of backache and dysmenorrhea.

Careful history taking and study of the clinical symptoms, together with painstaking examination, should be the basis for diagnosis. The two expected features of the clinical picture, pyuria and bladder disturbance, are very often absent. Cystoscopic and roentgen-ray procedures are but methods of proving or disproving the digest of the clinical picture.

Carson, W. J., Milwaukee. Dilatation of the ureter in the female. Autopsy findings. *J. Urol.*, July, 1927, xviii, 31.

In 115 consecutive autopsies on females, ureteral dilatation was found in 31 cases (37 per cent) bilateral 18; right 11; left 2.

Forty-nine ureters were found dilated in 31 females with the kidney pelvis above dilated in forty-six instances.

Pregnancy is the most frequent cause of ureteral dilatation in women.

Ureteral stricture, inflammatory in origin were found in 4 cases, bilateral 1.

A congenital ureteral stricture, right side, is reported.

Deming, C. L., New Haven. Primary carcinoma of diverticulum of the bladder. *J. Urol.*, July, 1927, xviii, 73.

Primary carcinoma of a diverticulum of the bladder is a rare condition. So far 10 cases have been reported with 9 deaths. All were males, 8 of whom were in the seventh decade. Intermittent hematuria with obstruction and signs of urinary infection are the outspoken symptoms. A majority of the tumors were of a papillary nature. The etiology is as obscure as is the etiology of tumors of the bladder in general.

Marshall, V. F., and Reed, C. C., Appleton, Wis. Reduction of cervical dislocation. *J. Am. M. Ass.*, July 16, 1927, lxxxix, 191.

Marshall and Reed recommend the method of Walton. The essentials of Walton's plan of reduction are: (1) dispensing entirely with extension, and (2) using only retrolateral flexion and rotation. The proper method is simply to raise the depressed process and rotate. This can be accomplished only by extending the head obliquely backward toward the right or left as the case may be and using the transverse process on the same side as a fulcrum. The ligaments which have held the vertebra firmly in its faulty position do not offer opposition to this movement, so that force is not required first to elevate in this way and then to rotate to the proper position. The patient should be thoroughly anesthetized (nitrous oxide), and should be in the sitting position. This gives freedom of movement and prevents confusion of the proper movements of reduction.

Johnson, R. W., Baltimore. A study of the healing processes in injuries to the carpal scaphoid. *J. Bone & Joint Surg.*, July, 1927, ix, 482.

Bone repair takes place in the scaphoid in exactly the same manner as in the medulla of the diaphyses, but the process is not as active or extensive. There is no interference with vascularity of the fragments of a fractured scaphoid which would cause necrosis or interference with hyperemia and secondary delayed union or non-union.

In these experiments approximation of fragments is so close that mobility or displacement played no part in retarding union. No lytic action of synovial fluid is observed. Lack of all periosteal callus is a large factor in causing slower fusion of fragments into a solid mass.

Fractured hyaline cartilage heals by fibrous tissue, and adjacent but undamaged hyaline cartilage also often undergoes vascularization and fibrous change. This gives rise to permanent changes of the articulating surfaces and is probably the element most responsible for bad functional results seen clinically in these fractures.

All bones of this cancellous type heal more slowly than the long bones. This is due largely to the lack of subperiosteal callus formation, but is also due in part to the cancellous reaction being less extensive and less active than is the medullary response in the diaphysis.

Mayer, L., New York. Transplantation of the trapezius for paralysis of the abductors of the arm. *J. Bone & Joint Surg.*, July, 1927, ix, 412.

Mayer reports a method of substituting the trapezius for paralyzed arm abductors, in which he employs fascia lata to lengthen the muscle instead of Lange's silk strands. The fascia is sutured to the cut edge of the muscle, tubulized and brought down through a cut in the acromion process and a tunnel made in the humerus.

Essential to success of the procedure is the presence not only of a strong trapezius and serratus magnus, but also of one additional muscle, either the clavicular portion of the pectoralis major, the biceps, or the coracobrachialis. The operation has the advantage over arthrodesis that it gives a more complete range of abduction and the esthetic effect is more pleasing. It has the disadvantage of requiring at least three months of postoperative exercises. Mayer has done this on 6 patients.

Morton, D. J., New Haven. Metatarsus atavicus. The identification of a distinctive type of foot disorder. *J. Bone & Joint Surg.*, July, 1927, ix, 531.

A painful disorder of the anterior portion of the foot, for which the term "metatarsus atavicus" seems to be most applicable, presents two characteristic signs which warrant its recognition as a definite clinical entity. The first of these characteristic signs is a morphological one, manifested in the unusual shortness of the first metatarsal bone, as compared with the length of the second. The other is the clinical symptom of tenderness elicited by deep pressure on the sole of the foot in the region of the second metatarsocuneiform joint.

Identification of this type of disorder facilitates the recognition and treatment of what appears to be a very large group of painful foot cases. Although in its range of subjective symptoms the present condition simulates other metatarsal disorders, the means of diagnosis and the elements of treatment are distinctive and specific.

The intensity of symptoms is not determined by the degree of disproportion in the length of the first and second metatarsal bones alone, but to an equal degree by the violence and distribution of the strains and stresses to which the foot is subjected. Hence, an adult foot with only a mild shortening of the first metatarsal bone, but which is subjected to frequent severe strains or prolonged periods of standing, is more likely to present disabling symptoms than one with greater inequality in the length of the bones, but which is not subject to heavy or vicious usage.

The early part of the treatment consists of eliminating the effects of chronic traumatic irritation. When this has been accomplished, conditions have been restored which characterized the efficient and painless state of this type of foot prior to the onset of symptoms. Subsequent care does not seem to require more than the use of conservative measures in order to maintain that symptomless state.

Cooperman, M. B., Philadelphia. Gonococcus arthritis in infancy. A clinical study of forty-four cases. *Am. J. Dis. Child.*, June, 1927 xxxiii, 932.

Periodic examinations of hospital help and routine bacteriologic studies of cervical and vaginal smears of expectant mothers before admission to maternity hospitals are prophylactic measures in eliminating these as possible sources of gonorrhea.

The importance of an early diagnosis of gonococcus sepsis in the newborn housed in hospitals cannot be too strongly emphasized. The disease once introduced into such institutions spreads with incredible rapidity, infecting all newborn infants who are exceedingly susceptible to the infection. Such prodromal symptoms as mild elevations of temperature, skin eruptions, superficial abscesses and swelling of the joints should make one suspect the presence of gonorrhea, the diagnosis of which can be made in the early stages by rectal and vaginal smears and bacteriologic studies of joint exudates.

The rectum is a portal of entry for gonococci that hitherto has not been sufficiently stressed. The organisms invade the blood stream shortly after the initial local implantation and rapidly metastasize to predisposed joints.

Two forms of gonococcus arthritis are observed in infancy, one accompanied by a great deal of swelling and tenderness suggesting suppuration and the other, a subacute synovitis with effusion. Multiple arthritis is the rule in 75 per cent of the cases.

Infantile joints, because of their cartilagenous nature, display a marked resistance to the infection. Suppuration of the joints exceedingly damaging to the adult articulations and producing terminal ankyloses was not observed as sequelae in any of the cases.

Gonococci may invade the medullary cavities of the long bones and set up localized destructive processes. Spontaneous recovery occurs, as proved by the roentgen ray.

The hip-joints were the most serious of the complications, becoming spontaneously dislocated in the early stages of the infection. The prognosis in these cases is not favorable, owing to the structural damage to the acetabular cavity and femoral head.

Casts, aspirations, incisions and diathermy are the best remedies in the treatment of gonococcal arthritis. Vaccines are of doubtful value.

The effect of the gonococcus infection on the epiphyses was to retard their growth, delay the appearance of centers of ossification and in cases of the capital epiphyses of the femur and humerous to produce fragmentation and even complete absorption.

The sequelae are best treated by physical therapy. The dislocations of the hip-joints should not be reduced before two years of age.

Peabody, C. W., Detroit. Chronic synovial tuberculosis. *Ann. Surg.*, July, 1927, lxxxvi, 92.

Five patients suffering from a chronic joint disorder of from two to seven years' duration presented physical findings inconsistent with those commonly looked for in established joint tuberculosis, and roentgenograms negative for bone destruction or absorption. All came to radical operation widely exposing the joint and revealing longstanding tuberculosis throughout the synovial membrane unaccompanied by any lesion of bone. Four were adults between ages of twenty-three and thirty-one in excellent general health and free from constitutional stigmata of tuberculosis. In none did a preoperative diagnosis of joint tuberculosis seem to have clinical support.

Chronic, slowly progressing tuberculous arthritis exclusively synovial, though not usual, is a definite clinical entity to be kept in mind in differential diagnosis. In chronic monoarticular joint disease biopsy of the synovial membrane may frequently be necessary for diagnosis.

Putti, V., Bologna. New conceptions in the pathogenesis of sciatic pain. *Lancet*, July 9, 1927, ccxiii, 53.

Sciatic pain is symptomatic of vertebral arthritis excepting in those rare cases in which it is a symptom of a neuritis of specific nature. Sciatica is a neuralgia caused by pathological conditions of the intervertebral foramina and especially of the intervertebral articulations. In other words, sciatica is a symptom of neurodocitis and lumbarthritis.

The terms rheumatic sciatica and idiopathic sciatica should be substituted by the more precise and adequate one of arthritic or vertebral sciatica.

To treat the sciatica it is necessary to treat the arthritis.

The treatment of vertebral arthritis is based upon the same principles as the treatment of all other arthritis of non-specific origin, therefore active hyperemia and immobilization. When these two methods are inefficacious it will be necessary to resort to resection of the diseased articulations.

Ney, K. W., New York. A rapid and simple method of determining nerve injuries in the extremities. *J. Am. M. Ass.*, July 16, 1927, lxxxix, 189.

In 1700 nerve injuries systemic examination has revealed that these injuries, with very rare exceptions, all involve, to some degree, even in the slightest injuries, the motor function of the fingers and toes, and that, with the exception of the upper arm type of brachial plexus lesions, an inspection of movement in the fingers and toes will reveal nerve involvement. The upper arm type of brachial plexus lesion may be readily determined by paralysis of the deltoid, biceps or triceps—most commonly all three. Injuries to the anterior crural nerve resulting in complete loss of extension of the leg are exceedingly rare, as the nerve on leaving the abdominal cavity has divided into a number of branches, all of which are rarely involved, and in serious injuries the involvement of the adjacent femoral artery completely overshadows the nerve lesion. An injury to the musculospiral nerve in any part of its course, even to the lowest portion of the posterior interosseus nerve, will result in loss of extension to the thumb. Therefore, inability to extend the thumb completely immediately suggests a musculospiral involvement. With the median nerve, injury in any location will affect the opponens pollicis, making it impossible to oppose the palmar surface of the thumb to the pads of the extremity of the fingers. While it may be possible to flex the terminal phalanx of the thumb through the long extensor, or the first phalanx by action of the flexor brevis pollicis, which is partially supplied by the ulnar nerve, it is impossible to rotate the thumb over the palm. In injuries of the ulnar nerve, the interosseus muscles are conspicuously involved, which prevents lateral movement of the fingers. Examination of the fingers will reveal the absence of these lateral movements by the inability to make the fingers into a cone; that is, bunching the ends of the fingers. Normal ulnar motor action will permit the formation of a four-finger cone; normal median nerve action will permit the rotation of the thumb and the placing of its palmar surface against the tips of the ulnar cone, making a five finger cone. Musculospiral injuries may be further confirmed by determining the presence of anesthesia over the dorsal surface of the base of the thumb, also inability to elevate the wrist and extend the fingers at the metacarpophalangeal joint. If the patient can make a four-finger cone, but is unable to oppose his thumb to the finger tips to make a five-finger cone, he has a median nerve paralysis, which may be confirmed by determining the loss of sensation in the palmar surface of the first three fingers and by the inability to flex the index finger when the other fingers are extended. A patient who is unable to make a four-fingered cone has an ulnar paralysis which may be confirmed by determining the loss of sensation in the little finger, and by testing the action of the interosseus muscles in individual lateral movements of the fingers. In examination of the lower extremities to determine the presence of an injury to the sciatic trunk or its two terminal divisions, the tibial and peroneal nerve, it is usually sufficient to inspect movement in the toes. If the toes can be extended, one may readily conclude that the peroneal nerve and the peroneal portion of the sciatic (external popliteal) have escaped injury. If the toes can be flexed, the tibial nerve (internal popliteal) and the tibial portion of the sciatic have escaped injury. If the patient is unable to extend the toes, a peroneal injury may be confirmed by the loss of sensation in the cleft between the great and second toe—also by the loss of dorsal flexion in the foot (extension). The inability to flex the toes means an injury to the tibial nerve or the tibial portion of the sciatic, which may be confirmed by loss of sensation in the sole of the foot and the toes, and the inability to plantar flex the foot.

Corlette, C. E., Sydney. On irritable ulcer of the leg or malleolus, and its cure by operation. *Med. J. Australia*, May 28, 1927, I, 782.

Irritable ulcer of the malleolus is a pathological entity with definite clinical characteristics. Though most frequent over the malleoli, it may occur in other situations. It depends on a morbid change in a cutaneous nerve. The ulcer is not the primary lesion, but a development in the course of the disease. Nerve-endings exposed in the ulcer form a factor in the production of pain, but pain precedes the formation of ulcer. There may be more than one ulcer at the site of the disease. The limb on which the lesion is situated shows signs of a defective circulatory apparatus. Certain individuals display a marked predisposition towards manifestations of the disease. It is not unusual to find two separate lesions of the

same kind in the same individual at the same time, and there is a tendency towards fresh outbreaks. These are not necessarily always on the same limb. The lesions are extremely refractory to treatment usually considered suitable for ulcers, but even though they have defied other treatment for years, they can be cured in a few days by subcutaneous section of the nerve supply. In a series of cases there have been no failures, and the cure seems to be complete and lasting. But the operation does not influence the individual predisposition, and therefore does not protect against new outbreaks in other malleoli or elsewhere. It is claimed that the evidence is so abundant, so strong, and so satisfactory that the older methods of treatment should be abandoned, and that early operative treatment should now be adopted as the routine.

The method involves a minor operation with a tenotomy knife under local anesthesia. Put the patient to bed for a preliminary rest period of two or three days with the leg well elevated. Foment the part till clean. The local anesthetic is a solution of novocaine, 0.5 per cent (I have also used cocaine, 0.1 per cent), in normal saline containing adrenalin, 1:150,000. Infiltrate the subcutaneous tissue above and on either side of the diseased area (the whole of it, not the ulcer merely). Wait a few minutes. Make a small incision in the skin above the diseased area just sufficient to admit a long-bladed tenotomy knife, and push this down on either side so as to sever all the tissues from just beneath the skin down to the deep fascia or the bone. Turn the blade carefully towards the skin so as to make sure of severing all the subcutaneous tissue, and then turn it towards the deeper parts, usually with a slight undercutting slant, and cut right down to the bone if it is the lateral malleolus, or on to the deep fascia close to the bone if it is the medial malleolus, taking care not to go deep enough to enter the deep compartment containing the vessels. Thus on either side is produced a subcutaneous division of the tissues in the shape of an inverted v. Keep the patient in bed for a week or ten days. The wound should not be interfered with after the operation, one dressing being all that is required.

The pain disappears at once. The ulcer and other lesions heal in a few days. A patch of anesthesia remains in the skin over and below the malleolus.

Telford, E. D., and Stopford, J. S. B., Manchester, England. Two cases of thrombo-angiitis obliterans in women. *Brit. M. J.* June 25, 1927, 1140.

Telford and Stopford report two cases of what they call thrombo-angiitis in women, aged about 50, one chronic and one moderately acute, both involving the upper extremities.

As they say, it may reasonably be objected that in the absence of histological proof these two cases may not be instances of thrombo-angiitis obliterans.

They say this strange disease is by no means peculiar to the Jewish race; all their cases have been of pure British blood. Meleney and Miller describe twenty-four cases from Peking, and Whyte has reported many cases in Chinese and says that the disease occurs in nearly all the provinces of China.

Kleinberg, Samuel, New York. Pulmonary embolism following oxygen injection of a knee. *J. Am. M. Ass.*, July 16, 1927, lxxxix, 172.

In a case of pneumarthrosis, pulmonary embolism and cardiovascular failure immediately followed the accidental injection of oxygen into the circulation. The heart stopped beating first, followed in about five minutes by the cessation of respiration. Artificial respiration was instituted, but for about ten minutes the patient was apparently dead. An injection of epinephrine hydrochloride into the heart revived the patient and prevented what appeared a certain catastrophe. The accident was the result of faulty technique, which is acknowledged in detail, so that it may never happen again. The author in making this report hopes that it will not deter others from using pneumarthrosis, which is an invaluable diagnostic test in doubtful and properly selected cases.

Way, S. C., San Francisco. Lattice fibers. Their diagnostic value in epithelioma. *Arch. Dermat. & Syph.*, July, 1927, xvi, 25.

This paper has been written in the hope of presenting a new means of determining (1) the transition from a simple type of growth to one in which malignancy is becoming evident, and (2) the comparative degree of malignancy shown.

The criteria on which stress has been laid are those related to the lattice fibers—their spacial

distribution and amount. These have been elucidated by a staining method (Maresch-Bielschowsky) which combines great clearness with specificity in its results.

An epithelioma may be said to be benign when it is entirely surrounded by a dense, thick network of lattice fibers, provided that the cancer cells do not penetrate into the surrounding fibers and there is a definite line of demarcation between the two.

An epithelioma of the ordinary type may be said to be malignant when the lattice fibers surrounding the cancerous growth are few or practically absent, and when, instead of showing a sharp line of demarcation between the two, the cancer cells penetrate into the bordering lattice fibers.

When an epithelioma originating from a nevus has a stroma composed largely of lattice fibers, and when few similar fibers occur at the periphery of the growth, it should be regarded as highly malignant. The more densely surrounded by lattice fibers a malignant growth is, the less is the tendency toward metastasis.

Lattice fibers are always absent in a benign, noninflammatory pigmented or nonpigmented nevus.

Wood, Dorothy A., San Francisco. Nitrous-oxide-oxygen anesthesia of children. Report of two hundred anesthetizations of children under ten years of age. *California & West. Med.*, July, 1927, xxvii, 68.

1. Nitrous oxide is the anesthetic of choice, especially in respiratory tract infections, tuberculosis, high fevers, diabetes, kidney diseases, and acute infections of the ear, nose and throat.

2. Children bear nitrous-oxide-oxygen anesthesia as well as adults, and there should be no age limit for its use.

3. Contrary to the old theory, children seem perfectly able to handle a closed system of anesthesia.

4. The technique of administration to children is the same as to adults.

5. Color changes in pale children are difficult to detect, and these children should receive a larger percentage of oxygen in the mixture.

6. No ill-effects were noted from repeated anesthetizations of the same subject.

7. Two hundred administrations of nitrous-oxide-oxygen were made without ether, without complications and without a fatality.

Cantor, S. J., Melbourne. The treatment of hiccup occurring during anesthesia. *Med. J. Australia*, June 11, 1927, I, 858.

It has been found that some cases of hiccup are not associated with a tendency to vomiting and the administration of the anesthetic either in increased dosage or in diminished dosage or even withdrawal of the anesthetic does not relieve the hiccup. The action of firmly holding the nose and the application of pressure to various parts of the face alike fail to check the trouble. It is, however, immediately arrested by forcibly flexing the head on the chest for a couple of seconds.

This method of arresting hiccup is dramatic in its action; it does not interfere with the surgical operation; it is safe. Relapse is uncommon and is cured in the same way.

The method of stopping vomiting during anesthesia by holding the nose was described by Cantor ten years ago.

Anderson, C. M., Hermosa Beach, Calif. The use of glucose and insulin in the prevention of surgical shock. *California & West. Med.*, July, 1927, xxvii, 56.

From his observations Anderson believes that surgical shock is a suboxidation due principally to insufficient elaboration of insulin in the tissues, with a resultant acidosis, probably intracellular, as suggested by Crile. He gives glucose by mouth.

Bruce, James W., Louisville, Ky. Transfusion in infancy. *South. Med. J.*, July, 1927, xx, 515.

Citrate transfusions, while possibly not so efficient as whole blood transfusions, are much more practical on account of the ease of performance. For this reason they are preferable in children in the vast majority of cases.

Careful matching of bloods, the use of freshly distilled water, and maintenance of body temperature in the injected blood will make reactions few and not severe.

Intraperitoneal injection of blood has a field of usefulness where intravenous transfusion is impossible.

Transfusion should be done while there is still good hope of the patient's recovery, and not as a last resort.

Cummer, C. L., Cleveland. Dermatitis produced by balsam of Peru. *Arch. Dermat. & Syph.*, July, 1927, xvi, 44.

There does not appear to be any reasonable doubt of the occasional irritating and toxic effect of balsam of Peru. Since the condition occurs but rarely, even when the drug is employed as a routine treatment, it is probably a question of idiosyncrasy. The reports indicate that when an unfavorable local effect is noted, it usually takes the form of an eczematoid dermatitis, severe enough in some instances to result in ulceration, though in one patient a morbilliform erythema was seen. Absorption may take place after local application, and this may be followed by severe toxic signs, fever, enteritis and nephritis. Occasional fatalities from absorption have been reported.

SUPPLEMENTARY ABSTRACTS OF ROENTGENOGRAPHY AND RADIUM THERAPY

Arens, Robert A., and Bloom, Arthur R. A case of abdominal pregnancy. *Radiology*, July, 1926, vii, 65–66.

A woman aged thirty-six was admitted complaining of severe pain in the lower abdomen and of vaginal bleeding. The roentgenograms of the abdomen disclosed the presence of fetal structures, the entire skeleton being clearly visible. The fetus was of about four and a half months of age, and instead of lying within the pelvis it was found in the right iliac fossa extending above the iliac crest. The head and neck appeared sharply flexed upon the spine, suggesting skeletal collapse. From its size and location it appeared to be an abdominal pregnancy.

At operation an almost black amniotic sac was seen lying free in the abdominal cavity. This was ruptured, and a macerated, partly desiccated fetus measuring 26 cm. in length was removed. This case is undoubtedly one of primary abdominal pregnancy in which the fetus had gone to about four and a half months.

Bellucci, Bruno. Chronic osteoarthropathy of the spinal column from the point of view of roentgen examination. *Arch. di radiol.*, July-Aug., 1926, ii, 485–533.

Roentgenography gives even a better picture of changes in the spinal column than post mortem examination becuse there are no post mortem changes. As a result of roentgen examination it has been possible to group the various diseases of the bones and joints of the spinal column into a few quite clearly defined groups while there was great confusion under the old method of grouping them according to clinical symptoms. Of course there are transition types that make a careful study of the clinical symptoms necessary in connection with the roentgen picture.

The chief groups of chronic spondylitis are those of known etiology (tuberculosis, syphilis, trauma, neuropathy) and two groups of unknown origin, the deforming and ankylopoietic. In traumatic spondylitis there is a history of trauma some months or possibly even some years before. The spondylitis is quite strictly limited to the injured vertebrae and there is no osteophytosis of other vertebrae. There may be fractures, luxations, subluxations or bone callus which remove all doubt of the traumatic etiology. Traumatic spondylosis may also assume the form of traumatic kyphosis described by Kümmell and Henle. There are attacks of pain alternating with free periods and a kyphosis with a large arch, the vertex of which is sensitive to pressure.

The most characteristic feature of tuberculous spondylitis is Pott's deformity. There are also the parrot's beak osteophytes, but these are not specific; they are found in various forms of chronic spondylitis. Chronic syphilitic spondylosis is rather rare. It shows a condensing osteitis with hypertrophy of all the bone, while in the tuberculous form there is rarefying osteitis with diffuse decalcification and atrophy of bone. In the syphilitic form there is almost always a periosteal reaction which is hardly ever seen in the tuberculous form and the fungosities which are practically always present in the tuberculous form are never seen in the syphilitic form.

Chronic neuropathic spondylosis is also rare. It may occur in tabes, syringomyelia or Parkinson's disease but is most frequently seen in tabes. In spondylosis from tabes the lumbar column is most frequently affected while in the syringomyelic form the cervical column is generally affected. While this form of spondylosis may cause great deformity of the spinal column it rarely causes pain or signs of compression of the spinal cord. There is flattening of the vertebrae and osteoporosis. The articular surfaces are very irregular. The greatest change in tabes is generally in the 3d and 4th lumbar which are reduced to the form of cones; there is generally great deviation of the spinal column. There are frequently queer hypertrophic lesions in the form of osteophytes, exostoses, bridges and calcareous masses which may be detached from the spinal column and form free fragments. In this form of spondylosis there is both atrophy and hypertrophy with the former predominating.

Of the two primary forms of spondylosis, spondylosis deformans almost always affects subjects more than forty years of age and the

two sexes about equally, while ankylotic spondylosis is almost always in young men. Spondylitis deformans affects only parts of the spinal column, most frequently the lumbar segment and there are changes in both the bodies of the vertebrae and the intervertebral discs. The discs are atrophied and sometimes disappear completely so that the bodies of the vertebrae are in contact with each other. There is hypertrophy and thickening of the bodies of the vertebrae and the margins protrude, forming bridges and parrots' beaks. Sometimes these osteophytes are branching or in the form of fungi. There are also signs of osteoporosis in the form of clear spots irregularly distributed. There are no signs of uniform total decalcification and malacia such as are seen in rhizomelic spondylosis. There is ossification of the articular ligaments but never ankylosis.

The ankylotic form begins in the intervertebral joints and is inflammatory in nature as distinguished from the form described above which is purely degenerative. It generally affects the whole spinal column. The bodies of the vertebrae are normal in form and height and only show excessive transparency due to osteoporosis. There are no osteophytes. The intervertebral discs are normal.

In illustration of some of the above points the author describes 5 clinical cases with roentgenograms. Three were cases of tuberculous spondylosis, one of syphilis and the other probably traumatic, although it was impossible to make an absolutely definite differentiation between that and primary chronic spondylosis. In 3 of his 5 cases there was sacralization of the 12th dorsal vertebra. He thinks defects of this kind are not necessarily congenital but may be caused by changed static conditions in the spinal column due to pathological causes. He believes that the bridge-like osteophytes are a defense measure designed to immobilize the spinal column and so put it in the best position for healing. This explains why osteophytes sometimes develop at a distance from the pathological focus in the spinal column.

Bellucci, Bruno. Two cases of inguinal fistula, one communicating with the sigmoid colon and the other with the bladder. *Arch. di radiol.*, July-Aug., 1926, ii, 561–568.

The first patient was a young woman of twenty-two who at seventeen had had an exudative pleurisy and about three years ago an attack of abdominal pain with high fever. Her physician made a diagnosis of peritonitis, prescribed local applications and in two weeks she was well. In a few months she began to have general malaise and evening rise of temperature which was thought to be due to an apical lesion. In May, 1925, a swelling developed in the left inguinal region which increased in size until it was as large as an orange. It was opened and a large amount of pus discharged, but she did not improve; the fistula continued to secrete and her temperature remained around 38° to 38.5°. She was sent to the author in March, 1926. Examination showed a lesion of the right apex and intense and uniform opacity of the left base. A roentgenogram of the pelvis and spinal column made because he suspected a bone abscess, was entirely negative. Barium sulphate was then injected into the fistula and the roentgenogram showed that the tract communicated freely with the upper part of the sigmoid. The barium outlined the whole course of the sigmoid and had collected in the terminal part of it. There had never been any discharge of gas or feces from the fistula. The primary disease had probably been a circumscribed peritonitis following specific ulcerative colitis. A localized abscess developed which slowly made its way to the skin through the muscles of the abdominal wall. There were probably folds in the fistulous tract which made it possible for the contrast liquid to flow inward but which prevented feces or gas passing outward.

The second patient was a young woman of twenty-three married at nineteen who had never been pregnant. About eighteen months ago while she was in good health a swelling the size of an olive suddenly appeared in the right inguinal region. She had frequent desire to urinate, only a small amount of urine was passed and she had a burning pain during and after micturition. The urine was turbid. About two months after it appeared the inguinal swelling opened spontaneously and a yellowish white liquid was discharged. The ulceration healed but broke down again and this happened three times before she came for treatment in December, 1925. At that time micturition was normal and the urine clear. She had never had fever except for a period of about fifteen days the preceding summer. Urine had never been passed through the fistula. Injection of contrast fluid however showed that the fistula communicated with the bladder. At the upper pole the bladder communicated with two irregular cavities which were connected with each other and with the fistula. Operation showed that the fistula had originated from an abscess of the left adnexa.

Bergamini, Marco. Foreign body (screw) in the digestive tract of an infant. *Radiol. med.*, November, 1926, xiii, 788–799.

Bergamini describes the case of an infant six months of age who swallowed a screw which

had fallen into its mouth. The screw was passed with the stool thirty-eight hours later without having caused any symptoms and without causing any after-effects. He followed its course through the digestive tract by means of roentgen rays and found that food passes quite rapidly through the digestive tract of infants of this age. Other cases have been reported in which foreign bodies have been passed without any injury. In such cases the foreign body should be followed up by roentgen-ray examination and nothing done as long as it passes normally. No manipulations should be made to hasten its passage and no surgical intervention attempted. Sweetened gruel may be given to facilitate the passage of the foreign body but purgatives are dangerous.

Bernstein, Arnold. Obstructions in the duodenum. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, February, 1926, xxxiv, 245–252.

Five cases are reported in which there was interference with the passage of material through the duodenum and in which no mechanical cause of stenosis could be demonstrated or could suffice to explain the condition. The symptoms observed were characterized by a much prolonged stay of the contrast material in the duodenum or certain portions of it, and increased shadows in the dependent portions of the duodenum. The severer forms of these cases may be very similar to true duodenal stenosis.

These cases are explained as being due to disturbance of the normal duodenal function and as having a causal relationship to diseases of the duodenum itself or of adjacent organs. The recognition of functional obstruction of the duodenum is important first in the differential diagnosis of true stenosis, and second, in that it indicates some pathologic organic process in the duodenum or in its near vicinity. The latter may be due to (1) an increased output of the stomach followed by a failure of the duodenum to accomplish the increased work; (2) failure of the pyloric reflex or presence of an open pylorus; (3) disturbance in peristalsis; (4) disturbances in normal function of the mucosa due to pathological conditions within it.

A characteristic roentgen picture in these cases shows the contrast material which normally traverses the duodenum in a few seconds to take several minutes to pass through the duodenum. In practically all of the cases there could be observed a to-and-fro movement of the contents. A re-examination after two hours usually discloses a considerable shadow formation in the dependent portions of the duodenum. In all of the cases that were operated on extensive periduodenal adhesions were found but no actual stenosis. Occasionally there was an actual narrowing in the upper portion of the duodenal lumen, but the interesting thing is the fact that the picture of obstruction seen roentgenographically included the whole length of the duodenum.

Breitländer. Central osteoplastic sarcoma of the vertebrae in the roentgenogram. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, April, 1926, xxxiv, 523–525.

A report is given of a case occurring in a boy aged fourteen who had fallen from a bicycle. He developed neuralgic pains in the lower extremities, which became acute. Introduction of lipiodol yielded nothing definite. The oil settled down to the level of the first lumbar vertebra in a non-characteristic fashion. The clinical and roentgenological signs suggested an osteosarcoma of the fifth lumbar vertebra. There was an unusual density in the structure of this vertebra while the remaining vertebrae appeared entirely normal structurally. The fifth lumbar gave a uniformly heavy shadow without signs of a structure. Its density was so great that even in the frontal roentgenogram it showed up quite clearly.

A laminectomy was performed and a myelogenous spindle cell sarcoma was found which had caused a central softening of the fifth lumbar vertebra producing a large cavity filled with soft tumor mass. This was associated with a very pronounced new bone formation of the cavity wall so that the vertebra appeared in the roentgenogram as a structureless osteosclerotic segment. This sclerosis was confined to the remainder of the spongiosa since there was no periosteal new bone formation. This observation appears to be of unusual interest. It also shows that a differential diagnosis could not be established by roentgenographic means alone.

Carty, John R. An unusual carcinoma of the esophagus: Case report. *Radiology*, July, 1926, vii, 63–64.

The patient was a man aged forty-five, somewhat emaciated, who complained of hoarseness and difficulty in swallowing for the preceding three weeks. There was a hard, fixed, deep-seated mass in the lower portion of the right anterior carotid triangle. The roentgen examination showed a smooth annular area of constriction at the level of the lower margin of the body of the second thoracic vertebra. The gullet above was markedly dilated and formed a pouch just proximal to the lesion. The barium was seen to pass straight to the constriction without first going to the bottom of the pouch and then spilling over. A very small irregular

stream passed through the stricture. The laryngoscopic examination showed a paralysis of the right recurrent laryngeal nerve. A bit of tissue taken at the point of stricture showed squamous cell carcinoma. The patient was able by swallowing air rapidly to distend the dilated esophagus, which pushed the trachea forward and caused marked respiratory distress. By flexing the head forward he was able to release the air, and the trachea assumed its normal position.

GALDAU, DEMETRIO. Osteopathology of the knee joint. *Radiol. med.*, October, 1926, xiii, 708–710.

A man aged sixty-eight was admitted to hospital in July, 1925 for pain in the right knee. It had begun in August, 1923 when the patient was working in water, caught cold and had pain in the left knee; after a few weeks it passed to the right knee. The patient was able to walk up to the end of November, 1924 but after that was bedridden. He was anemic and weak and there were signs of fibrous tuberculosis in the lungs. The right knee was swollen and sensitive, movements reduced, leg flexed on the thigh. Exploratory puncture gave a yellow liquid with no blood. Left knee also somewhat swollen but not painful.

The roentgenogram showed the classical signs of tuberculous arthritis: great atrophy, lack of periostitis, etc. In the lateral projection, in addition to these symptoms, a sort of spur of bone could be seen with its base implanted on the anterior surface of the upper third of the tibia and with its free upper extremity directed toward the joint. The left knee also showed the signs of tuberculous arthritis, but to a less degree, and the same spur. And on the proximal and distal margins of the patella shadows could be seen passing upward and downward following exactly the direction of the patellar ligament and the tendon of the rectus femoris muscle. These shadows were undoubtedly due to calcification of the patellar ligament and the tendon of the rectus femoris. The author does not believe there was any relation between the tuberculous arthritis and these pathological new formations of bone, because tuberculosis is a decalcifying disease. And the fact that the new formations of bone in the two joints showed the same degree of development while the tuberculous lesions differed in degree also indicates that they were independent of each other. He thinks the calcification developed before the tuberculosis because the bone spurs also showed atrophy due to arthritis.

Mainoldi published a similar case in 1925 which he thought was an unusual form of Osgood-Schlatter's disease. Galdau thinks this interpretation is entirely wrong and that the calcifications were due to poor nutrition of the region caused by arteriosclerosis.

MEYERDING, HENRY W. The surgical aspect of bone tumors. *Radiology*, July, 1926, vii, 29–35.

Few physicians are so skilled as to assume willingly the sole responsibility of diagnosis, prognosis and treatment of new growths. The roentgenologist or the surgeon who is experienced in the interpretation of roentgenograms of osseous lesions may strike a high percentage of correct diagnoses. There are, however, certain lesions that baffle the clinician, surgeon and roentgenologist until exploration is performed and gross and microscopic findings are made available.

Unless the surgeon can make a positive diagnosis of a localized benign tumor he must depend on the roentgenogram to determine the local or general type of the growths and differentiate them if possible. When a malignant growth is found he must depend on the roentgenogram or evidence of pulmonary metastases. If metastasis is not found and operation is decided on, right angled views of the lesion give important data as to the site, size, origin, penetration or invasion of periosseous structure and as to whether the condition is benign or malignant. No operative procedure is justifiable when malignancy is suspected without the roentgenographic examination of the chest. Occasionally multiple benign tumors, multiple malignant tumors and metastasis to bone from the internal organs must be differentiated, and here again the roentgenogram plays an important part.

In the last analysis the clinical and laboratory findings, the gross and microscopic findings and the roentgenograms should all be considered, as it is through cooperative effort that the greatest value of the therapeutic agents can be secured.

The surgical aspects of osteochondroma are discussed and an illustrative case is cited in a young man aged eighteen. The tumors appeared to arise in the cortical and central areas at the ends and middle of the bone of the hands. These tumors were covered with a thin layer of bone and trabeculations due to irregular growth, and bony septa were distinctly visible in the roentgenograms.

A case of osteitis fibrosa cystica in a man aged nineteen is described from the surgical and diagnostic view points. There was a bony enlargement over the fifth metacarpal of the right hand, the roentgenogram of which suggested tumor. The growth was slowly enlarging.

Roentgenograms showed cystic degeneration of the fifth metacarpal bone, middle and proximal phalanges of the fourth and fifth fingers. The contents of the cysts were removed and after thorough curettage the cyst walls were crushed in and the wounds closed without drainage. Facultative anaerobic diphtheroid bacilli were cultivated from the cyst contents.

A case of giant cell tumor is described in a woman aged twenty-two. The roentgenograms of the stiff left knee suggested the diagnosis of sarcoma. Further roentgenograms disclosed an area of destruction just above and involving the upper portion of the internal condyle. The tumor, which was irregular and hazy in outline, apparently originated at the epiphyseal line, destroyed the cortex, and invaded cancellous bone. There was no line of demarcation between the tumor and the periosseous structures. Amputation had previously been advised but at operation a soft tumor was thoroughly curetted and actual cautery applied. The wound was packed and a deep drain with 50 mg. of radium was left in for twenty-four hours. The pathologist's report upon the excised tumor tissue was "giant cell tumor." The patient recovered from the operation and has shown no signs of recurrence seven years since operation.

A case of endothelioma (Ewing's tumor) is described in a boy aged thirteen who complained of a rapidly growing tumor of the lower end of the left femur. Roentgenograms revealed sarcoma of the lower third of the left femur and in the chest there were signs of active metastases. Amputation through the upper third of the femur was performed and the pathologist reported an annular osteosarcoma 10 cm. long and 1 cm. in diameter. The patient recovered from the operation and left the hospital on the ninth day. Roentgen therapy was administered over the stump, groin, chest, back, pubis and the axillae daily. Coley's toxin was given twice a week. The patient gained in weight and there was no indication of recurrence at the stump. Four months later he was taken ill with what was thought to be heart disease and died suddenly. In this case the roentgenogram of the left femur showed distinct osteolysis of the shaft due to invasion by the tumor and sclerosis and osteogenesis of the shaft. Formation of new bone within the invading tumor was abundant as shown by the presence of radiating spicules. The roentgenogram showed clearly the inaccuracy of the term "periosteal sarcoma" when applied to such tumors of osteogenic type.

Another case of endothelioma in a boy aged sixteen is described. In this case operation offered relief for twenty-five months during which time the patient enjoyed a comfortable existence.

Mulligan, P. B. Syphilis of the stomach: Report of case. *Radiology*, July, 1926, vii, 62–63.

A case is reported in a man aged twenty-eight complaining of vomiting and dull ache in the upper abdomen. The physical examination was negative except that the patient was much emaciated.

The roentgenographic examination of the stomach showed it to be very small with marked deformity of the pars media producing hourglass formation and giving the stomach a dumbbell appearance. The constricted area was about 2 cm. long and about the thickness of a lead pencil. There was slight retention in the upper loculus at the end of six hours. The roentgen diagnosis was syphilis or malignancy, and although there was a negative history of venereal disease the patient's age and lack of cachexia would indicate syphilis if the Wassermann reaction should be positive. The reaction did turn out to be positive and salvarsan treatment caused disappearance of the symptoms and a return to good health.

Muzii, Mario. Biliary calculus and cyst of the pancreas. *Arch. di radiol.*, July-Aug., 1926, ii, 577–583.

A young woman of eighteen was sent to the author with a diagnosis of gallstones. A roentgenogram of the liver region on a film 24 × 30 with a Potter-Bucky diaphragm in the dorsoventral direction showed two irregularly round opaque shadows both of them a few centimeters outside the spinal column, one at the level of the intervertebral disc between the 1st and 2d lumbar, the other between the 2d and 3d; they lay within an elongated shadow with clear outlines with a rounded lower pole extending from the shadow of the right psoas to the shadow of the kidney and partly superimposed on the latter. In a second roentgenogram in the ventrodorsal direction with a Potter-Bucky diaphragm also and exercising pressure on the abdominal organs the two shadows could be seen displaced outward and upward and isolated from the kidney shadow. In the dorsoventral picture they were smaller and had clearer outlines than in the ventrodorsal one, which showed they were nearer the anterior wall. These findings showed beyond doubt that they were two gallstones, but it did not explain the reason for the distance between them or the difference in their position in the two projections. The latter could only be explained by great mobility of the gall-bladder or liver and the former on the supposition that the shadows

represented only the nuclei of the gallstones or that they were separated by other stones that were not visible.

But the gallstones did not explain all the clinical picture, as the history showed that recently the right subcostal pain had become epigastric, fixed and constant without any special relation to the gall bladder region. Palpation also showed that the area of greatest pain was beneath the ensiform process of the sternum and that there was a uniform round resistance here. A roentgen picture of the gastrointestinal tract showed an indentation of the lesser curvature of the stomach, displacement of the stomach to the left and a filling defect of the antrum and pyloroduodenal region from pres re on the part of a round body outside of and posterior to the stomach. There was evidently a tumor here but its nature could not be determined from the roentgenogram.

Prof. Busi made a probable diagnosis of cyst of the pancreas from retention, due probably to a calculus in its descent having injured the mouth of the pancreatic duct in Vater's papilla. He admitted however that it might be a retroperitoneal echinococcus cyst. Operation showed a mobile cornuate gall-bladder containing several stones, two of them large ones with calcareous nuclei, the ones that showed in the roentgenogram. It also showed a retention cyst of the pancreas. The patient recovered and is in excellent health.

Pazzi, Ermanno. Anterior luxation of the body of the sternum on the manubrium shown by roentgen examination. *Arch. di radiol.*, July-Aug., 1926, ii, 569–576.

A man of thirty-five was thrown from his automobile when a front tire burst and then the machine overturned on him. He struck on his head and there was a large lacerated, contused wound of his scalp in the left parietooccipital region. When the machine fell on him he felt an intense pain in the chest. There was a swelling at the angle of Louis; the patient complained of painful pressure in the anterior part of the thorax which increased on inspiration and on movements of abduction, extension and elevation of the arms. The skin was intact over the swelling; there was no crepitation on palpation but a certain mobility in the lower half of the swelling. The roentgenogram showed that the body of the sternum was displaced forward on the manubrium and the two parts were completely detached from each other but that there was no fracture. This case is interesting from the fact that isolated lesions of the sternum are rare; it shows that luxation of the body of the sternum on the manubrium can be produced by indirect violence and the roentgenogram confirms what has been reported by other authors, that in this form of luxation it is the manubrium which remains in place while the body is displaced forward.

Pazzi, Ermanno. Another case of multiple myeloma of the bones diagnosed by roentgen examination. *Radiol. med.*, November, 1926, xiii, 799–803.

A man aged forty-six with no personal or family history of any importance suddenly had intense pain in the back with radiation to the lumbar region. These attacks were repeated for some months after which he had no more acute attacks but a constant dull pain in the lumbosacral region. Various diagnoses were made such as arthritis, uricemia, rheumatism, lumbago. When he was sent to the author's genito-urinary clinic a roentgen examination of the kidney region was made as is done systematically in all cases. This showed great changes in the vertebrae, especially the 12th dorsal and the 3d lumbar. Another examination of the ureteral and bladder region showed changes in the sacrum, pubis, ilium and heads of the femurs. The bones, especially the spongy parts, were spotted, with decalcified transparent areas and others darker from condensation of bone. These zones were more or less rounded but with irregular outlines and of various size. The vertebrae were flattened. The same changes were found in the bones of the head and arms and in the ribs. Bence-Jones bodies were found in the urine. This case of multiple myeloma of the bones could not have been diagnosed in any other way than by roentgen examination.